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THE AMERICAN SOCIETY OF ZOOLOGISTS

I.

THE fifth annual meeting of the Eastern Branch of the American Society of Zoologists, and the eighteenth since its establishment as the American Morphological Society, was held at the Sheffield Scientific School of Yale University on December 26, 27 and 28, 1907.

The following officers were elected:

President—William Morton Wheeler, American Museum of Natural History.

Vice-president—Herbert S. Jennings, Johns Hopkins University.

Secretary-Treasurer—Lorande Loss Woodruff, Yale University.

Member of the Executive Committee—Gilman A. Drew, University of Maine.

Eight investigators were elected to membership, making the total membership of the Eastern Branch 143.

The society voted to contribute 100 francs to the Lamarck Memorial Fund.

The following papers were presented:

Some Stages in the Life History of Hæmogregarina stephanowi, Danilewskya, of Turtle's Blood: C. W. HAHN.

This hæmosporidian was discovered by Danilewsky in 1885. Through the work of Saccharoff, Labbe, Langman, Simond, Börner, Siegel, Brumt and DuCloux we know that it is closely related to *Lankestrella minima* of the frog, which has been the subject of more extensive research. But the results of the investigation which is here reported go to show that the structure and life history of *H. stephanowi* can not be considered a very close parallel to

those of *L. minima* as described by Hintze (1902). We find a sexual generation made up of micro- and macrogametocytes with corresponding gametes, a zygote resulting from this conjugation, and a zygocyst with from 24 to 32 sporozoites, also an asexual generation arising from sporozoites and repeating itself again and again by schizogony, in which from two to twenty merozoites are produced. This cycle is completed entirely within the vertebrate host.

We have worked out a basis of relationship in the changes which the nucleus regularly undergoes after each division. It passes through about eight different structural conditions in its reconstruction, whether it be during the cleavage of the zygocyst, the schizont, or the gametocytes or in the growth of the gametocytes and schizonts. After division the nucleus is either in the form of a homogeneous dense karyosome, or it proceeds to assume this condition. A number of spaces appear in the karyosome, giving rise to a coarse network. This network becomes a fine structure with enlarged nodes, the latter becoming definite chromatin bodies. The network is in direct communication with the nuclear membrane. In the next step, both nuclear membrane and achromatic network are lost and the chromatin bodies, about sixteen in number, lie apparently free in the cytoplasm. They become dumbbell shaped and divide, giving rise to about thirty-two daughter chromatin bodies. These either diminish rapidly in size, while an achromatic matrix replaces them, or move apart in two groups and then give place to the matrix. The latter becomes the karyosome of the next cycle.

We have reason to believe there is an alternation of the sexual with the asexual generation in this animal. In several carefully studied cases, one generation is present almost to the exclusion of the other. Associated with this condition is another which lends support to the theory of alternation of generations. Schizonts, microgametocytes, and macrogametocytes which develop from merozoites that are associated with zygocysts, are markedly different in structure from these same types when they grow from merozoites that are associated with gametocytes, gamet cysts and gamets, *i. e.*, sexual stages. Moreover, the last-named merozoites are produced by schizonts incapable of dividing more than once or twice, while the first-mentioned merozoites are the progeny of very prolific schizonts. It has been convenient to distinguish the schizonts, microgametocytes and macrogametocytes of the prolific type as "primary," and the others as "secondary" individuals.

Blackhead, a Coccidial Disease of Turkeys: Leon J. Cole, Yale University, and Philip B. Hadley, Brown University.

Variation, Correlation and Growth in Paramecium: H. S. Jennings, Johns Hopkins University.

Sexual Reproduction in Amœba: M. M. Metcalf.

Effects of Alcohol on the Division-Rate of Infusoria: Lorande Loss Woodruff, Yale University.

The experiments summarized were conducted for considerable periods on two species of protozoa, *Paramecium* and *Stylonychia,* whose status in the life-cycle was known through long cultures, and on a sufficiently large number of individuals to afford reliable averages. It is believed, therefore, that the results obtained afford clear evidence of the general effect of alcohol on the division-rate and, therefore, on the metabolism of the organisms studied.

The evidence thus brought forward shows clearly that:

1. Minute doses of alcohol (1/2,500) will decrease the rate of division at one period of the life-cycle, and increase it at another period of the life-cycle.

2. When alcohol (1/2,500) increases the division-rate, the effect is not continuous, but gradually diminishes, and finally the rate of division falls below that of the control series and remains there.

3. An increase (doubling) of the amount of alcohol administered, however, will again cause a more rapid cell division for a limited period, but again this effect is not constant and the rate of division falls below the control. Up to the present time (December 26, 1907) the alcohol has been increased in amount (doubled) three times, always with the same result.

4. Treatment with alcohol lowers the resistance of the organisms to copper sulphate.

The Acclimatization of Stentor to Alcohol: J. FRANK DANIEL, Johns Hopkins University.

Solutions of alcohol above 4 per cent. were found to be early destructive of the protoplasm of *Stentor cæruleus.* In a strength of 1 per cent. or lower, however, the animal lived without apparent injury.

At the end of four days stentors kept in a weak solution had so adjusted themselves as to be able to live in a slightly stronger percentage; further, when killed in a strength of 6 per cent. they gave an average resistance period of twice the control value.

By rearing these ciliates in a weak solution of alcohol plus water of very great purity the factor of food may be eliminated. In such a medium they gained markedly in resistance, thus demonstrating that the lengthened period of resistance was due to the direct effect of the alcohol upon the protoplasm and not to an indirect effect upon the food conditions of the culture.

In solutions weaker than 0.4 per cent. no acclimatization was indicated until after the second day. Those kept in a constant strength of either 0.5 per cent. or 1 per cent., however, showed a clear adjustment at the end of the first day, as, for example, reared in 0.5 per cent. and tested in 6 per cent., average resistance 127 seconds, control value 99 seconds; in 1 per cent., 166 seconds, with a control of 120 seconds. In all cases there was a noticeable increase on either the fourth or the fifth day which marked the maximum of resistance for the series. Following this maximum there was a gradual decline, the cause for which is, as yet, undetermined.

Inheritance in Protozoa: H. S. JENNINGS, Johns Hopkins University.

Some Maturation Stages of the Mouse Egg: J. A. LONG.

E. L. Mark presented some of the conclusions reached by Mr. J. A. Long—a student in Harvard University—especially as to the number of chromosomes. It was imagined a year ago that possibly the number found by Sobotta and confirmed by Kirkham (twenty-four somatic, or twelve reduced) differed from the number counted by Tafani and the author (twenty, reduced) because different breeds or strains of mice actually presented different conditions in this respect. But the courtesy of Professor Coe in loaning some of Dr. Kirkham's preparations for study has led to the belief that differences in the number of chromosomes counted is due rather to the complications of form and grouping presented by the chromosomes than to any difference in the actual number of them.

A critical study of a large number of preparations—between five hundred and a thousand—has shown that, while the chromosomes present a variety of forms at different stages, they are really—as might

have been expected—(1) in the first maturation spindle tetrads, of which there are only twenty present; and (2) in the second maturation spindle dyads. Each dyad is, of course, composed of two monads, but the monads composing a dyad are often deeply constricted, each having a marked dumb-bell shape, so that the whole dyad simulates a tetrad. Since all dyads do not necessarily show this dumb-bell condition of their component monads, the counting is rendered difficult; but the recognition of the possibility of this condition is essential to a satisfactory counting of the chromosomes. These the author maintains are twenty, not twenty-four. Preparations showing the conditions described and illustrated on the blackboard were shown.

The author also is of opinion that the first polar cell gradually atrophies, and by gradual diminution in size finally disappears.

The Maturation of the Egg of the Rat: W. R. Coe, Yale University.

The eggs both of the common brown rat and its albinic variety have been studied in numerous preparations, many of which were made by Dr. W. B. Kirkham. In the formation of the polar bodies, the eggs of the rat agree closely with those of the mouse, the development of which have recently become well known by the publication during the past year of the researches of Kirkham and of Lams and Doorme. As in the case of the mouse and most other mammals which have been studied, the egg of the rat invariably forms two polar bodies, the first of which is produced in the ovary, while the second is formed in the Fallopian tube immediately after the entrance of the spermatozoon into the egg. At the time of ovulation the egg has therefore already formed its first polar body, and the second polar spindle has become fully developed. The entrance of the spermatozoon stimulates the egg cell, and the second polar body is immediately extruded. Eggs which have formed the first polar body, but which for some reason fail to be discharged from the ovary at the time of ovulation, degenerate and eventually break up into fragments, simulating an irregular, abnormal cleavage. These degenerative changes are brought about, at least in part, by the abnormal activities of the previously formed second polar spindle.

The first polar spindle is easily distinguished from the second by the nature of the chromosomes, the former containing, as Kirkham has described for the mouse egg, tetrads which differ considerably in size, and which often split precociously into dyads, while the latter contains either dyads or the separated and often rodlike univalent chromosomes. Both spindles may show at their poles one to three or more dark granules, usually of irregular shape, which may be looked upon as centrioles.

As in the mouse, also, the second polar body can usually be distinguished from the first by the arrangement of the chromosomes. In the first polar body these chromosomes are usually scattered irregularly, while in the second polar body they are commonly fused together into a dense nuclear mass even before the complete separation of the polar body from the egg substance.

The egg of the rat, furthermore, resembles that of the mouse and differs from most other mammalian eggs in that in the vast majority of cases the first polar body has disappeared before the egg reaches the Fallopian tube. Eggs in the course of fertilization and cleavage, therefore, are usually accompanied by but a single polar body, namely, the second.

The entire substance of the spermatozoon enters the egg, the head quickly forming

a typical sperm nucleus, while the tail stains intensely and occupies a position close beneath the vitelline membrane for more than half the circumference of the egg.

A Contribution Towards an Experimental Analysis of the Karyokinetic Figure: FRANK R. LILLIE, University of Chicago. (To be published in the proceedings of the Central Branch.)

The Accessory Chromosome of Anasa Tristis: EDMUND B. WILSON, Columbia University.

Certain contradictions in the literature have led the author during the past year to make an exhaustive re-examination of the history of the accessory chromosome in *Anasa tristis,* paying particular attention to a comparison of sections, smears and material in the unfixed, unstained condition. These various methods give thoroughly consistent results, which appear with an elementary clearness that excludes all obscurity of doubt. All the essential facts in this species are as the author previously described them, and are uniformly and consistently as follows:

In *Anasa tristis* the fundamental somatic number is in the male 21 and in the female 22. During the growth period of the spermatocytes the unpaired or accessory chromosome retains the form of a condensed chromosome-nucleolus until the early prophases of the first division. It then elongates to form a longitudinally split rod, again condenses to form the eccentric chromosome of the first division, and divides equationally in this division. In the second division the grouping of the chromosomes usually changes, and an eccentric position is no longer characteristic of the odd chromosome. During the division this chromosome passes undivided to one pole, which receives eleven chromosomes, while the other pole receives ten. The spermatozoa are, therefore, of two classes, equal in number; and comparison of the male and female groups shows that the eleven-chromosome class must be female-producing, the ten-chromosome class male-producing. These results have in the meantime been independently confirmed by a number of other cytologists.

Abnormal Development of Frog Embryos as a Result of Treatment of Ova and Sperm with Roentgen Rays: J. H. MCGREGOR, Columbia University.

Wood-frogs (*Rana sylvatica*) were taken at the breeding season when about to discharge the sexual products and exposed to moderately strong Roentgen radiations for periods varying from twenty minutes to two hours, after which each one was placed in a dish of water with a frog of the other sex. In the series of experiments were cases where both were exposed, and others where only the male or only the female was exposed. In all cases the frogs paired promptly and all the females deposited eggs.

The study of the development of the eggs yielded some interesting results, which may be stated in very general terms as follows: Where only the female was exposed, the male being normal, all the eggs developed, about 5 per cent. of them developing various abnormalities. Where the female was normal, the male only exposed; only about 5 per cent. of the eggs were fertilized and of these the majority developed various deformities during early stages. When both were exposed the result was practically the same as when the male alone was treated.

The deformities were of various types, among which may be noted bladder-like distension of cœlom, tumor-like proliferations on various parts of the body, double tails, and atrophy of certain parts of the brain. Of two larvæ which lived five

weeks one had no eyes, the other only one. At the time of exposure of the frogs the eggs were probably in the first polar-body stage, the spermatozoa practically ripe. The cytological study of the material has not been completed.

The Effects of a Centrifugal Force on the Eggs of Cumingia: T. H. Morgan, Columbia University.

Rapid rotation drives the yolk to one pole of the egg, the nucleoplasm to the opposite. The polar spindle lies in the protoplasm of the middle zone of the egg, and its orientation is little affected by the centrifuging. The polar bodies may be given off at any point of the surface. The cleavage is like that of the normal egg in all respects, even when all the yolk lies in the smaller of the first two cells. This shows that the determinate type of cleavage is not affected by the distribution of the yolk, nucleoplasm or pigment, or by the stratification. In this last respect the results are different from those in the centrifuged eggs of the sea urchin, because, while in *Cumingia* the position of the nuclear spindle is not changed by the centrifuging, in the sea urchin the female pronucleus is driven into the axis of stratification. In general, a resting nucleus may be forced to the lighter pole of the cell, owing to the presence in the nucleus of nuclear sap, but the chromosomes and the spindle are more difficult to move, since they have nearly the same specific gravity as the cytoplasm. When they move they do so as a whole, which shows that the spindle figure when present is a definite structure. Embryos develop from the stratified eggs of *Cumingia,* but whether normal embryos develop for all possible distributions of the different materials of the egg has not as yet been positively determined.

Degeneration in its Relation to Classification: Charles B. Wilson.

On examining the writings of those investigators who have dealt with the group of copepods it is found that nearly every part of the copepod's body has been used by one or another as a basis of classification. There are nearly as many different schemes of classification as there are authors. Is there anything, aside from the inherent excellence of the writings themselves, which will assist us in deciding their scientific merit? Can we say that any one of the schemes is more rational and logical than the others?

In endeavoring to answer this question it seems to me that we must take into account first of all the fact that considerably more than half of the group live as parasites or semi-parasites on other animals. One of the most common results of parasitism is degeneration, in consequence of which an organ loses its function, then its size and shape, and finally may entirely disappear. No one questions for a moment the influence which development should have upon classification; any scheme which left development out of consideration would be branded at once as worthless. Why should not degeneration, which is the reversal of development, prove of equal value, especially in a group where it is so finely illustrated as in the copepods?

There are several things which strongly recommend it. It proceeds even more slowly than development, so that we are enabled to follow every step in the process, and almost never need be at a loss. In development it often happens that several new organs appear at a single moult about equally advanced, and it is very difficult to decide which are of the greatest value from a systematic point of view. The newly hatched nauplius has three pairs of appendages, the first and second antennæ and

the mandibles. At the moult from the nauplius into the metanauplius we find in addition two pairs of maxillæ, often two pairs of maxillipeds, and sometimes one or more pairs of swimming legs. To which of the three nauplius appendages should preference be given, and if the mouth-parts be chosen as a basis of classification which of them possesses the greater value?

Degeneration quietly eliminates these appendages one by one; why may not its testimony be taken when the case is so difficult of decision otherwise?

Again development requires that we obtain the eggs and rear the young through successive stages; any one who has tried this on the copepods realizes how very difficult it is. And even when accomplished, many of the conditions are of necessity abnormal, and in consequence might produce abnormal results.

Degeneration, on the other hand, is produced upon the adults in their native habitat and surrounded by their usual conditions. We can obtain and study the results with comparative ease; we are not obliged to reproduce any of the conditions.

Degeneration thus determines in the copepods which of the appendages are the most stable and the least susceptible to change; it selects the first antennæ from among the nauplius appendages and of the mouth-parts the mandibles as the most stable and the first maxillæ as the least so. Consequently that classification is the best which is the most fully based on these stable elements. We find such an one originally proposed by Thorell in 1861, corrected by Claus in 1862, by Gerstaecker in 1881, and finally by Canu in 1892.

Wound-reparation and Polarity in Tentacles of Actinians: HERBERT W. RAND, Harvard University.

At the Bermuda Biological Station for Research, in the summer of 1907, I studied the reactions resulting from cutting the tentacles of certain large actinians (*Condylactis* and *Aiptasia*). If a piece of tentacle is removed by a transverse cut, within a few minutes the open cut end of the stump is closed by a concentric inbending of the wall of the tentacle. The newly closed end is hemispherical except for the presence of a small cylindrical nipple-like projection at its center. This closure is effected by contraction of the circular muscle fibers. The "nipple" results from extreme contraction of the circular fibers immediately proximad of the plane of cutting. Within a day or two after the cutting there ensues a rearrangement of the elements of the tissues in the vicinity of the cut, whereby results a permanent closure which is not dependent upon muscular contraction. Thus, the reparation of the wound exhibits two phases. A temporary repair is effected by active muscular contraction pending the slower reorganization of the tissues by which the muscular tension at the cut end is relieved and a permanent repair established.

The closing of a distal cut end and the formation of a "nipple" in the manner described above take place in a tentacle after it has been severed from the column. This fact can not be interpreted as indicating autonomy of fragments of the organism. The piece of tentacle is a fragment of the actinian, but it is not a fragment of the actinian organization because in it are embodied the essential features of the entire organization.

When an excised tentacle is cut transversely into several pieces, each piece shows a definite polarity in that its two ends assume distinctly different forms. Thus, in any transverse zone of the tentacle two modes of response to transverse cutting are potentially present. In the event of transection either one or the other mode

of behavior will be exhibited, depending upon whether that zone comes to lie at a proximal or a distal cut end. No structural basis for this polarity has been found.

An Experimental Study of the Rate of Regeneration in Cassiopea xamachana: Chas. R. Stockard, Cornell Medical School.

When a peripheral ring of tissue is removed from the disc of *Cassiopea* the cut surface promptly begins to regenerate a new rim. The nearer the cut is made to the center of the medusa-disc, up to a certain limit, the faster will the resulting regeneration take place.

Regeneration from variously shaped cut surfaces proceeds in exactly the same manner as has been described in experiments on the fins of fishes. Thus the same principles of regeneration seem to apply to the formation of new tissue from appendages and the true body surface of animals. Further, a common principle or law regulating the rates of regeneration may probably run through the animal kingdom, since forms at almost opposite ends of the series, the fish and medusa, regenerate in a similar manner.

A bias-cut strip of the entire periphery of the medusa-disc and the remaining central portion gives a preparation in which the influences due to the level of the cut may be contrasted with those due to degree of injury. Influences due to the level are alone indicated by the ensuing growth. Regeneration in either direction, towards the periphery or towards the disc-center, proceeds at approximately the same rate from the same level.

Ring preparations made from these medusæ are splendid objects for the study of the influences due to functional activity. Portions of the ring which are entirely at rest throughout the experiments regenerate tissue at the same rate as other parts which pulsate normally. Functional activity shows no influence over the rate of regeneration in this form.

Medusæ having one or more of their eight oral-arms removed regenerate these arms at irregular rates which are not closely associated with the degree of injury. Medusæ injured to the same degree often show greater variations in their specific rates of regeneration than are found among individuals injured to different degrees. A medusa with several of its oral-arms cut away in a similar manner may regenerate the individual arms at rates differing as much as do the average rates shown among many medusæ injured to various degrees.

The influences of changed physical conditions on the rate of regeneration were tested, as well as the effects due to excesses of Na, K, Ca and Mg in the sea-water.

Regeneration of Peripheral Nerves: Ross G. Harrison, Yale University.

The nerves of one side of the tail of larvæ of *Rana sylvatica,* 2–2.5 cm. long, were cut with fine scissors just beyond the point of emergence from between the myotomes. The processes of degeneration and regeneration were then observed from day to day in one and the same nerve in the living specimen. The degenerative processes take place very rapidly. In less than twenty-four hours the medullary sheath is completely disintegrated beyond the lesion and for a very short distance central to it. In the axis-cylinder of both the medullated and the non-medullated nerves the signs of degeneration are less marked, though unmistakable, and are noticeable in even the finest and most remote twigs. The Schwann cells become less regularly spindle shaped, with a somewhat humpy surface, and do not adhere

so closely to the axis-cylinder. They are also found to contain a few granules. After one or two days it is found that the two cut ends of many of the nerves have united together by a protoplasmic bridge, and in such cases the degeneration of the peripheral part of the axis-cylinder is immediately arrested, indicating that in these larvæ a primary healing of nerve fibers is possible. The medullary sheath is not rehabilitated immediately and the process of re-formation of this structure resembles that of its initial development. When the peripheral portion of a nerve fails to unite with a central stump, degeneration continues and ultimately the nerve disappears, the finer twigs disintegrating first. When a central stump fails to unite with a peripheral end, regeneration by a comparatively slow process, in a centrifugal direction, takes place. There is no indication whatever of any power of "auto-regeneration" in the nerves whose connection with the central end remains severed.

Some Singular Cases of Regeneration and Increase in a Deep-sea Coral by Agamic Endogenesis: ADDISON E. VERRILL, Yale University.

The paper considered a cornucopia-shaped simple deep-sea coral, dredged by the U. S. Fish Commission in 57 to 179 fathoms, off the eastern coast of the United States. It was first described by Pourtales as *Parasmilia Lymani* (now *Dasmosmilia*). The walls of this coral are extremely thin and fragile, while the radial septa are strong. Therefore, when injured, it easily splits lengthwise into wedge-shaped fragments. Entire adult specimens are rarely taken. The larger fishes and crabs, living in deep water, are responsible for the breakages. Each fragment, even when very small, has the power to produce one or more buds on its inner surface, from the tissues covering the septa. If a single bud starts near the distal edge of a large fragment, it ultimately grows in such a way as to blend on the outer side with the wall and septa of the fragment, so as to appear, sometimes, like a mere repair of damages, with regulation of parts. But when the bud starts farther from the edge of the fragment, it may grow up vertically from it, later using it only as an object for its basal attachment. Several buds, sometimes as many as 6 to 8, may arise from the inner surface of a large fragment, growing up vertically or obliquely. If several buds start close together, they soon come in contact at their edges, as they grow larger, and graft themselves together, thus giving rise to bilobed or trilobed calicles in the mature corals, but when the buds stand singly, the calicles are circular. About one hundred specimens were studied, and of these there were very few that did not originate as buds, showing the fragment of the parent calicle still attached to the base.

In this coral there is, therefore, a gradual transition from the mere repair of an injury to the border of the calicle (or regeneration of parts) to complete and perfect buds. These various forms were illustrated by lantern slides.

Some Results of a Biometrical Study of Egg Production in the Domestic Fowl: RAYMOND PEARL and F. M. SURFACE.

This study is based on the statistics of egg production which have accumulated during the past ten years at the Maine Agricultural Experiment Station. During this period an exact trap nest record has been kept of the entire egg production of all laying birds during their pullet year. These records are of unique value in the analysis of the general problem of fecundity, since they furnish data on a single isolated factor—ovulation. The data here

discussed are from a single breed of fowls, Barred Plymouth Rocks. They are based on returns from several thousand hens. It is hoped that a detailed account of the results will be published shortly.

Variation in Annual Egg Production.—If frequency distributions of individual variation in total annual egg production be made, they are found: (1) to be unimodal; (2) to exhibit negative skewness in all but a few cases. In these cases the variation curve is symmetrical; (3) to conform to Pearson's Type I curve when unsymmetrical, and to his Type II curve when symmetrical: (4) to exhibit a high relative degree of variation (coefficient of variation = 35 per cent. ca.).

Comparative Distribution of Birds and of Eggs produced.—In consequence of the skewness of the variation curves it results that 50 per cent. of the total number of birds produce from 60 to 76 per cent. of the total number of eggs. This is of practical consequence in breeding, since it means that a random sample of eggs will not represent a random sample of the birds which produced them, but instead will include an unduly large proportion of heavy layers.

Monthly Distribution of Egg Production.—The maximum mean egg production is in March or April. Secondary maxima occur in January, June and September. These maxima are entirely independent of the total egg production, appearing in the records of the lowest as well as the highest egg producers. If the difference between the heaviest and lightest layers in respect to the mean egg production for each month in the year be taken, it is found to be smallest in March, April and May, largest in the late summer and early autumn months. The individual variation in egg production (measured either by standard deviation or coefficient of variation) is greatest in those months when the mean production is least, and *vice versa*. There is no sensible correlation between the egg production in the pullet year and that in the second laying year.

Some Effects of Differences of Temperature and Humidity upon the Post-natal Development of the Mouse: F. B. Sumner.

White mice which were transferred at the age of two to four days to two rooms having mean temperatures of about 45° and 75° F. respectively (the relative humidity being about twice as great in the former as in the latter) were found to exhibit great differences in tail length when measured at the age of 42 days. Although the mean weight of those kept in the warm room (51 individuals) was less than 6/10 gm. greater than that of the cold room lot (44 individuals), the mean tail length was 69.3 mm. in one case, and 52 mm. in the other, *i. e.*, there was a difference of over 33 per cent. Moreover, the shortest tail in the warm-room lot was longer than the longest tail in the cold-room lot.

In a previous experiment, in the course of which 20 mice in each lot were subjected to conditions similar to those stated above for a period of from 83 to 106 days, commencing with the fourth week after birth, the difference in tail length was 7.1 mm., or 11 per cent. of the tail length of the cold-room lot. On the other hand, the mean weight and the mean body length (distance from snout to anus) in the two lots was almost identical. In this experiment, the males of the cold-room series (13 individuals) were found to have an average of 305 hairs in a given unit of skin surface (2 disks, each 1.5 mm. in diameter), while those of the warm-room lot had, on the average, 267 hairs in the same area of skin. The variability in each case

was so great, however, and the number of individuals so small, that these figures may have no significance. More accurate measurements, based on a far greater number of individuals, are to be made in the near future.

Such an adaptive response as an increase in the density of the coat of hair, following a transfer to a colder environment, is popularly believed to occur in nature. On the other hand, an abridgment in tail length, as a result of cold, has been reported in the case of cats. Whether or not such somatic changes are inherited, or better, whether similar changes reappear in the offspring, is a subject under investigation by the author.

Physical Identity in Duplicate Twins: H. H. WILDER, Smith College.

Introduction.—Review of the morphology of the epidermic patterns in man, as brought out by the work of previous years, chiefly that of Inez Whipple [Wilder]. In the foot of a typical pentadactylous mammal there are eleven walking pads, surrounded by folds of skin, arranged in such a manner that the pads are embraced by the prolongations of two, three or four triradii. This formation, which is a high relief in walking mammals, becomes reduced to an approximately plane surface in primates, *i. e.*, a picture of the former relief. This loss of functional significance has, however, resulted in a more or less complete reduction of the individual features, and thus the patterns assumed by the epidermic ridges in man represent various degrees of reduction of the fundamental plan and are individually extremely variable. They also normally show little tendency to a bilateral symmetry, so that the patterns on the two hands or the two feet of a given individual are usually quite different.

Exhibition of the Prints of a Set of Twins.—[Set No. XX. of the author's collection.] These are the prints of two small boys in Portland, Me., Henry and Bernard. They are first of all remarkable in that the hands show the eleven typical patterns complete, a case so rare that it does not occur otherwise in a collection of the palm prints of about 450 individuals, including very varied human races. Aside from a striking resemblance between the four sets of members the prints show the characteristics which are usually to be noted in cases of true duplicates, viz:

(*a*) Bilaterality, so that all four palms have virtually the same pattern. The same is true of the soles.

(*b*) A remarkable reversal of the apical or finger-pattern of the index finger. The right pattern of one is an ulnar loop, while that of the other is radial; on the left hand the pattern of the first is radial while that of the other is ulnar. This condition, while not always found in twins which seem to be duplicate, has been observed in one side at least in more than half of the cases.

Conclusions.—The practical impossibility of finding so close a correspondence in any two children normally related, together with the other conditions noted, lead to the inevitable conclusion that in such twins we have a condition from the germ on that is unlike that which obtains in normal individuals. If we accept the most probable theory to account for the origin of such twins, viz., their origin from a single egg, it then follows that the general form of the epidermic patterns is predetermined in the germ immediately after fertilization, in short that in duplicate twins nature tries for us the important experiment of making two individuals out of the same germ-plasm and that the study of their palm and sole markings shows better than any other known features how great is the resem-

blance. Since, by a comparison of the prints, it may be seen that the resemblance is confined to the general patterns while there is no especial resemblance in the individual ridges (Galton's "minutiæ") we arrive at what may be called the limit of germinal control, *i. e.*, the point where the directive force felt in the development ceases to act, leaving further details to other forces.

Heredity in Epidermic Markings of Palms and Soles ("Friction-skin").—In a set of sole prints of a family, including three generations, the inheritance of a definite configuration over certain definite areas was followed by means of distinctive colors. In these prints a marked degree of hereditary influence was shown, especially in the inheritance of a "calcar pattern," one of the rarest features in the human foot.

The Four Inseparable Factors of Evolution, Theory of their Distinct and Combined Action in the Transformation of the Titanotheres, an Extinct Family of Hoofed Animals in the Order Perissodactyla: Henry Fairfield Osborn, Columbia University. (Published in full in Science, January 24, 1908.)

When do Variations attain Selection Value?: Bashford Dean, Columbia University.

One of the major criticisms of Darwinian natural selection showed that small fluctuating variations were not of actual value in the struggle for survival: accordingly, they would not be expected to accumulate in the direction of pronounced utility. And it is notably this criticism which lies at the base of various neo-Darwinian explanations. In the present contribution stress is laid upon the fact that variations may attain selection value without an accumulation of small and less useful stages. The stages in such cases occur, it is true, *i. e.*, as small fluctuating variations, rarely appearing suddenly, but they are meaningless in terms of selection.

This point of view was explained by a series of analogies, in which there was no ground to question the non-utility of the stages of cumulation. For the end result itself, although as highly complex as many of those which are granted selection value, could have had no significance in the struggle for survival.

Numerous analogies of this kind were cited: resemblances to human face in the pupæ of *Feniseca tarquineus* and of *Sphalgis s-signata,* on back of death's head moths, in Taira crab, on "ear bone" of whale, in seed-capsule of *Antirrhinum:* resemblances of tree hoppers to birds, of desiccation lines on seeds to ideographs, of the supraoccipital of an Indian goat to the face of *Entellus,* of the rabbit's sphenoid to a fox's head.

If such remarkably complicated resemblances could be attained by non-useful variations, it follows that some, if not many cases whose value has been debated (protective coloration, mimicry) may have had a similar accidental and meaningless origin.

Inheritance in Canaries: C. B. Davenport, Carnegie Station for Experimental Evolution, Cold Spring Harbor, N. Y.

Crest is a typical Mendelian dominant over plain head. Plain-headed canaries do not throw crests; and among crested birds of the second or later hybrid generation some may be obtained that produce only crested offspring. Baldness is a typical recessive to full head feathering. In the plumage color the yellow form is derived from the ancestral "green" canary by a dropping out of black pigment. The yellow canary carries, however, a mottling factor, so that in F_1 the green $\times$ yellow gives offspring that are yellow mottled

with black, forming "green" patches of variable extent. The behavior of the plumage color in subsequent generations supports the view that the gametic formula of the "green" canary is: *Nm* [*i. e.*, black (nigrum) pigment present, mottling absent] and that of the yellow canary is *nM* [*i. e.*, black pigment absent; mottling factor present]. Hybrids between the goldfinch and canary show, in the same way, the presence of the mottling factor; but the dark patches are usually extensive. The "reversionary" character of the hybrid is due to the original pattern of the wild canary that lies latent—because of lack of pigment, in the yellow canary.

The Sense of Taste in Fishes: G. H. PARKER, Harvard University.

In the common horn pout (*Amiurius nebulosus*) taste buds occur not only in the mouth and on the barbules but also over almost the whole external surface. Those on the exterior of the fish are innervated by branches of the seventh nerve. Horn-pouts will snap at a bait when it is presented to the flank of the body as well as when it is close to the mouth. The exterior of the body is also sensitive to sour, saline, and alkaline solutions, the head being more sensitive to these solutions than the trunk. In horn-pouts in which the branch of the seventh nerve distributed to the skin of the trunk has been cut, thus rendering inoperative the taste buds of the trunk, there is no longer a response to bait brought near the trunk, though the same bait is greedily taken when presented to the mouth. Such animals, however, retain their full sensitiveness to sour, saline, and alkaline solutions when applied to the skin of the trunk. That the loss of response to a bait when presented to the flank of a horn-pout after the severance of the seventh nerve is not due to shock is shown by the fact that this sensitiveness is retained by fishes in which the large lateral-line branch of the tenth nerve has been cut. After cutting the lateral branches of both the seventh and tenth nerves the only sensory nerves left intact on the flanks of the body are the branches from the spinal nerves. Since fishes in this condition respond to sour, saline and alkaline solutions, it follows that these solutions must stimulate the terminals of the spinal nerves and that these nerves must be regarded, therefore, as chemical in function, though they are not primarily concerned in the response to bait. In horn-pouts the posterior half of whose spinal cord has been destroyed but whose seventh nerve is intact, there is no response when sour, saline, and alkaline solutions, and bait are applied to the flanks near the tail. The absence of response to bait in this experiment is due, I believe, to the loss of the motor mechanism of the cord whereby the fish turns to snap at the bait and not to the loss of the spinal sensory fibers. The loss of these fibers would account for the absence of response to sour, saline and alkaline solutions. From these experiments it is to be concluded that the sense of taste in horn-pouts is complex and involves not only the seventh nerve, but also the spinal nerves.

The Organ of Claus in the Copepod Eucalanus elongatus Dana: C. O. ESTERLY.

E. L. Mark gave an account of some of the principal points regarding "The Organ of Claus in the Copepod *Eucalanus elongatus* Dana" which have been discovered by Dr. C. O. Esterly. There is a pair of these organs, and they are imbedded in the front part of the brain near its ventral surface. Claus, who discovered the organs in *E. attenuatus* Dana, thought they were otocysts. Esterly shows that they are not vesicular, but are solid, each

composed of two cells, and that their histological conditions are so nearly identical with those of the median eye, composed of three ocelli, that they must be regarded as organs of vision rather than of audition. The retinal cells of the median eye and of these organs both present peculiar basal plates, and the cytoplasm of the cells shows a marked but fine striation, which Hesse has erroneously regarded as homologous with the "Stiftchensaum" which he discovered in the eyes of many invertebrates. Esterly regards this striation as the expression of a structural condition due to the secretive activity of the retinal cells in producing the basal plates. The "Binnenkörperchen" of Hesse, or phaosomes, are present in the organ of Claus as well as in the ocelli, and are thought to be of importance in light reception.

There are ten retinal cells in the ventral ocellus, and nine in each of the lateral ocelli composing the median eye. From the basal-plate end of each cell emerges a single nerve fiber, these twenty-eight nerve fibers constituting the single optic nerve of the median eye. Two nerves emerge from each organ of Claus, one from that surface of each retinal cell which is opposite its basal plate. In this particular the organ of Claus differs from the ocelli, the former being eyes of the inverted type, whereas the ocelli are—contrary to the opinion of Hesse—not inverted. The neurofibrillæ appear to end in the retinal cells in beaded fibers having terminal club-shaped enlargements, which often have an intimate relation to the phaosomes. This suggests a possible functional relation between the two.

Six plates of original drawings by the author and reproductions of them by the photogravure process (A. W. Elson & Co.), together with some of the preparations, were exhibited.

The Luminous Organ of a New Species of Anomalops: Ulric Dahlgren, Princeton University.

The fish was taken by the writer in moderately deep water off the north coast of Jamaica, B. W. I., in March of last year. It will be described and named by Mr. C. F. Silvester, of the Princeton museum.

The fish shows several whitish spots on parts of the body and these spots may have a luminous function. This could not be determined.

The main luminous organ consists of two large "photophores" placed one under each eye. The photophore lies close to the eyeball and may be said to be a part of the under lid. When first seen it gives the impression of being a foreign substance in the eye and the native fisherman would not believe that it was not a worm. The length of the organ was about the diameter of the eye and it was oval in form. Its color was cream white and the presence of a large blood supply directly on the surface was noticeable in the form of a reticulum of red lines on what was apparently the outer surface.

The entire organ was somewhat loosely fixed and could be rotated laterally down under an edge of integument so as to be almost entirely concealed. The part under which it slipped had a thickened edge and could be regarded as a means of suddenly shutting off the light when it was necessary not to show it.

The structure of the organ can be very well made out in a single section taken transversely to the long axis of the animal's body and therefore to the longer axis of the photophore. This shows that the largest mass of the organ consists of a close set and parallel set of simple tubular glands reaching from the outer to the inner surface of the structure. These glands are

lined by a single layer of cubical cells whose distal ends terminate in an indefinite boundary between the substance of the cell and the mass of secretion that fills the lumen of the tubule.

But the secretion mass is not discharged into the water from these tubules. They open into a flat cavity, with enclosed sides, of the single (?) original invagination by which the gland was formed (presuming on the unknown embryology), and it is this thin outer layer of integument that contains the heavy blood supply.

Another system of capillaries is found between the tubules, and is evidently designed to bring a supply of food material within reach of the secreting cells, which are very active as measured by the amount of highly specialized product they secrete. The operation of the organ would appear to be as follows:

The secreting cells discharge the elaborated material (which is a "leuciferase") into the lumen of the tubular gland, which carries it up and passes it out into the outer flat spaces in contact with the inner side of the external integument. Here it is used, being consumed by the oxygen that is brought to it in the heavy blood supply of this integument. Its waste products of combustion must also be carried away by this blood and are probably extracted by the kidneys, along with the waste matter from the other body tissues.

Since the whole structure was probably derived from the stratified epithelium of the outer body surface, the secreting epithelium must be looked upon as the specialized basal layer of this invaginated region.

The whole gland lies on a layer of connective tissue which is modified to reflect light. This reflector is very efficient and when a mounted section is laid on a piece of black velvet, it alone shines out as a white line. Still outside of the reflector is found a layer of intensly black pigment. At its upper edge, this is useful in protecting the eye from the organ's light.

The thickened edge of the lower "lid" consists of an integument covering a mass of cells which appear to be nerve cells. This is probably some ganglion which is used to control the production of light.

The Poison Glands of Bufo agua: C. L. BRISTOL and G. W. BARTELMEZ.

The material was collected in Bermuda at the New York University Biological Station, the original habitat being South America. This toad has had the reputation of being poisonous to mammals, and we finally verified instances of poisoning. The poison acts only on a mucous membrane, and produces results similar to curari.

The poison glands are found only on the upper surface of the body, while mucus glands are found all over the skin, and are crowded together in large parotoid "glands" behind each ear. They are much larger than the mucus glands and extend deep down into the compact corium layer. They are surrounded by a thin layer of loose connective tissue which contains nerve fibers and a dense network of capillaries. There is an almost continuous layer of smooth muscle fibers about the gland. The cells of the glandular epithelium develop to an enormous size, and when they mature they disintegrate, their entire plasm becoming the secretion, so that when a poison gland has reached its full development it is simply a reservoir of poison. When the poison is discharged the remains of the gland are resorbed, and at the same time one of the five or six undeveloped glands, grouped around the mouth of the functioning gland grows down alongside the remains of the discharged gland, pushing it aside to occupy its former place.

(To be concluded)

EXTRACTS FROM A REPORT PRESENTED TO THE CORPORATION OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY BY ARTHUR A. NOYES, ACTING-PRESIDENT

FACULTY ORGANIZATION

THE faculty has during the past year perfected its organization and has made provision for carrying on more effectively its administrative functions by the creation of the office of chairman and by the appointment of new committees on faculty business, on faculty rules, and on the courses of instruction. Our faculty, like that of many other educational institutions, has now become so large that it can not properly deal with the details of administration; but instead of establishing a single administrative board consisting of a small number of its representatives, it has gradually developed the more democratic, and, we believe, the more effective, plan of placing its numerous and varied functions under the charge of about twenty-five standing committees, which are empowered to take final action upon all special and individual cases that arise, and are expected to take the initiative in submitting to the faculty for its approval any important changes of policy or procedure that seem desirable. I would especially call your attention to the resolution in which the faculty "expresses its appreciation of the desirability of some form of advisory relation between the corporation and the faculty, and its readiness to cooperate with the corporation in the preparation of a plan for establishing such a relation."

DEVELOPMENTS IN THE WORK OF INSTRUCTION

The curricula of all the strictly engineering courses have been modified during the past two years by the omission, wholly or in part, of the second-year work in modern languages; and the time gained has been utilized to increase the amount of instruction in English and history, and to give a more thorough drill in fundamental engineering subjects, especially in applied mechanics, structures and steam engineering. It is felt that few engineers make practical use of their knowledge of modern languages, and that the general and scientific studies that have been substituted are not only more directly useful, but either have a higher cultural value or provide a better mental training.

Important progress in the development of our advanced work has been made by greatly extending and systematizing the subjects of instruction offered to candidates in fifth-year courses leading to the degree of master of science. Almost every department has announced, and is prepared to offer in the next school-year, advanced courses of a somewhat more specialized character than can be given to undergraduate students. Thus in civil engineering, further work in the design of structures (particularly those of reenforced concrete), of railroads and of hydraulic works, is offered; in mechanical engineering, further study of turbine and gas engines and of machine design is provided for; in architecture, advanced courses in the various branches of architectural design are announced; and similarly in all other departments advanced work has been arranged for. The broad significance of this form of development and its bearing on the character of our undergraduate courses I shall speak of later.

A special inducement to pursue such advanced work has been offered to graduates from other colleges by a recent vote of the faculty, which permits them to enter at once upon a course leading to the degree of master of science without previously taking our bachelor's degree. This course will, in general, extend over a period of two or three years, varying according to

the previous preparation of the college student.

There are, however, no developments of any kind which are so important as those which tend to increase the effectiveness of our undergraduate instruction in meeting the needs of the individual student. I am glad to be able to tell you that this year an important step in this direction has been taken by the initiation of a plan of individual conferences between the instructor and students in certain first-year subjects. Owing to the inadequacy of the funds available for the purpose—for it involves additional instructors of first-rate ability—it has been possible this year to put this plan in force only to a limited extent in the subjects of English and mathematics. It is, we believe, of great importance that this plan be largely extended as rapidly as our facilities admit; for it is undoubtedly true that many of the students who now fail to reach our standards could overcome their difficulties if they could receive more help in learning how to study and more personal encouragement and stimulation. The conference plan also develops an attitude of cordiality and mutual helpfulness both in the instructing staff and the student body which is the essence of a healthy college spirit.

The instruction in the department of mathematics is undergoing a somewhat radical revision, in which the old divisions into advanced algebra, analytic geometry, differential and integral calculus are in large measure obliterated, and the whole subject is presented, irrespective of this traditional grouping, in a manner most economical and advantageous for the student, and with the help of a large number of concrete applications.

THE EDUCATIONAL FIELD OF THE INSTITUTE

It is well, I believe, for the corporation to take under consideration from time to time those fundamental principles which express the main purposes for which the institute exists and which should determine the educational field which it is to occupy and the directions in which it is to be developed. In this belief, I present my views for your consideration.

Its Function as an Undergraduate School

First of all, I believe that it should be clearly recognized that one of its main functions, as an independent scientific school, is to educate for the scientific and engineering professions young men who have previously received only a high-school education. It must remain in large measure a school for undergraduates, and must not allow itself through the influence of the policies of universities to become only a graduate school for the professional training of the former students of other colleges. The question here at issue is not which is more advantageous—a professional training preceded by a liberal education of an elective character or a coordination of the two in a single prescribed course—but whether or not there is a large field for education of the latter type. Some may prefer to drive tandem, with a loose rein upon the leader, and some to drive abreast; but none wishes his freedom of choice restricted. By the establishment in this community of the Graduate School of Applied Science at Harvard University, and by a similar development at other universities throughout the country, ample provision will doubtless be made, as fast as the demand arises, for the engineering education of college graduates. It should be, on the other hand, the especial care of the institute to maintain and develop that combination of liberal and professional training for undergraduate students, for which it has stood from its foundation. If ever the demand for this type of education should cease, or if ever it be demon-

strated that this type when properly developed produces only engineers and scientists of an inferior grade, then, and not till then, will it be time to consider the conversion of the institute into a purely graduate school. To abandon at this stage the educational experiment which the institute is making, instead of coping with the difficulties in its problem which have become apparent, would be a betrayal of the trust which its past imposes and a severe blow to the educational development of this country. There is as yet no indication that the sources that have directly fed the streams which are inundating our technological schools are drying up, nor is there as yet any adequate experience which warrants us in diverting those streams into a different channel. It is certainly desirable that there be developed the new type of engineering education, in which cultural subjects are given as collegiate courses and the professional training in a graduate school; but this is not *our* field of educational service. Such a development is to be welcomed, in part because it is a stimulus to us to study the conditions for making our own type of education more effective. We must therefore not allow our attack upon the problems of undergraduate education to be weakened by theories as to the tendencies of professional education under university conditions, nor by inconclusive comparisons between the results attained in graduate schools of law and medicine and those that may be expected in similar schools of applied science.

The second principle which I desire to emphasize is that already indicated by my preceding words, namely, that, as an independent undergraduate school, the educational problem of the institute is necessarily of a twofold character: we have to develop a plan of education which is adapted to produce not only well-trained engineers, but also broad-minded, high-purposed men. We must aim to make the work of the students at the institute and the conditions of their life outside such as lead to a duly proportioned development in these two directions.

It is sometimes said, however, that in attempting to solve this twofold problem in a four-year undergraduate course, the institute is undertaking a hopeless task. This contention I would meet by the statement, that, whether or not it be hopeless to give a fully adequate education upon these two sides within the period of four years, it is our present problem to do this in as large a measure as is possible; for to further increase this minimum period of study would close the doors of the institutions of technological education to a large number of young men whose financial resources are already taxed to the utmost. Moreover, the careers of institute graduates warrant the conclusion that the results attained in the past are as a whole satisfactory; and when the many possibilities of further development in our educational work and the conditions of student life are considered, the future outlook for a fuller success of the four-year course is a bright one. Before conceding the necessity of an extension of this period of study, we must at least consider the possibility of utilizing in part the intermediate summer vacations, which now cover no less than one third of the whole year: but to this matter I shall return later.

Specialization in a Fifth Year

The general principle which should determine the character of our four-year course of study—a principle fully recognized by our faculty—is that a liberal education be provided such as will develop character, breadth of view, and high ideals of service, and that professional education be mainly confined to a thorough training in the principles of the fundamental sci-

ences and in scientific method, specific engineering subjects being included only so far as the remaining time permits and as the minimum requirements of professional practise demand. It should be our aim not to turn out a specialist at the end of a four-year curriculum, but rather to provide for specialization in a fifth-year graduate course. By courageously eliminating from our fourth-year curriculum the more technical branches of instruction, however important they may be for the practising engineer, and by making more ample provision for them as subjects to be pursued in graduate courses, we shall, on the one hand, be enabled to make our undergraduate course more educational in the broadest sense, and, on the other hand, to make more evident to the student the practical importance of returning for a fifth year to acquire the more specialized knowledge of the separate engineering professions. This, then, is the direction in which, in my judgment, the courses of study at the institute should be developed: we will give in our four-year undergraduate course an even broader and deeper training than at present in cultural and fundamental scientific studies—a training which will still enable those students that are obliged to do so to enter at once upon the practise of their professions, handicapped somewhat, it may be, by the lack of technical experience, but with a sound knowledge of principles and a developed mental power which will gradually enable them to overcome this disadvantage; and, on the other hand, we will develop graduate courses of such a character as will obviously remedy this deficiency of insufficient specialization and will attract such graduates of this institution and of other scientific schools as are financially able to continue their education. We shall thus create a type of graduate school in which is offered advanced training for bachelors of science rather than for bachelors of arts.

Opportunities for College Graduates

But these are by no means the only fields which the institute should occupy. Some of the other directions in which our development must be continued or extended also deserve consideration.

We must, while not permitting any sacrifice of the instruction of our undergraduate students, encourage the graduates of colleges to enter the higher years of our regular courses and our advanced courses, and offer them such additional facilities as their different preparation demands. Future experience alone can determine whether such graduates will receive a better education in the graduate schools of universities in courses attended, often not only by themselves, but by college men without definite professional aim, or in scientific schools working side by side in the undergraduate courses with men earnestly devoted to preparation for their profession. The presence together of these two groups of men is certainly mutually advantageous: the graduate student from another institution tends to broaden the interests of his undergraduate associate; and the latter imbues the former with that spirit of hard work and seriousness of purpose which attendance at the scientific school has inspired. For these reasons we must not fail to provide suitable courses and conditions of work for the college graduates who are coming to us in constantly increasing numbers.

Five-year Courses for the Bachelors Degree

Far more important, however, than the offering of increased opportunities for college students, is a more ample provision within this institution itself for the education of such students coming directly from the preparatory schools as are able to

devote more than four years to general and fundamental studies. In emphasizing the importance of maintaining our undergraduate four-year course I should be sorry to give the impression that that period is considered a fully adequate one. On the contrary, I believe the institute should at once meet the demand for a broader education of its students by a development of a three-year course in general science, which shall contain, partly as required work, and partly as electives, all or nearly all those subjects of instruction now included in the first two years of the various courses of the institute, so that the latter may be completed in two years more by students who have finished the three-year science course. This plan would enable three years instead of two to be devoted to the humanistic branches of study, to the nature sciences, and to the fundamental physical sciences. It would in large measure provide the breadth of scholarship which the college course is designed to supply, and would do this by the methods and in the atmosphere of the scientific school. Owing to the facts that a long list of electives in general studies is already offered to our third-year students, and that many of the scientific subjects that would naturally be included are already given by one or other of our science departments, this course in general science could be arranged for at comparatively small additional expense. It would be desirable, however, that one new professor be appointed, who might offer courses in philosophy, psychology and logic.

ADVANCED STUDY AND RESEARCH

Development is also of the greatest importance in the direction of larger opportunities and inducements for research work and advanced studies in the pure and applied sciences which form the basis of our curriculum. An institution of learning which does not contribute through the researches of its instructing staff and graduate students to the advancement of science can not secure the highest grade of teachers, can not keep its courses of instruction upon the plane of broad and deep scholarship, and can not retain its educational prestige. I have already spoken of one kind of advanced course which we are already developing—one which would provide the more specialized instruction in engineering subjects which industrial advances are making more and more imperative. Such a course, which hardly needs to be of more than one year's duration, leads to the degree of master of science. There is, however, a second kind of advanced course which is even more essential to the development of the highest type of scientist or engineer. This is a course in which the student, while pursuing more advanced studies in the underlying sciences, devotes himself mainly to the original investigation of problems in pure or applied science. It is investigation work of this sort which tends to develop the creative power of the man and his ability to handle new problems relating to the improvement of industrial processes and engineering methods. Such a course, when of two or three years' duration, may lead to the degree of doctor of philosophy or doctor of engineering. The institute has already made encouraging progress in this direction; but the number of students engaged in such work has thus far been small.

REDUCED TUITION AND ADDITIONAL SCHOLARSHIP AID

Next in importance to this matter of making provision for our immediate needs and future development comes the question of reduced tuition fees or increased scholarship aid. The high cost of the kind of instruction furnished by the institute made it seem necessary a few years ago

to increase our tuition fee to $250. This increase will, I earnestly hope, be regarded as only a temporary expedient for which a remedy must be found at the earliest moment. The present high tuition not only is shutting out a large group of promising young men from the advantages of a scientific and engineering education, but is imposing upon another large group a financial burden which they are scarcely able to bear, and which forces them to live and to work under conditions unfavorable to their health and social development. Any of the administrative officers of the institute could recount numerous instances where men have been obliged to withdraw from the institute because they could not raise the last fifty dollars of their tuition, or where they have been living on thirty or forty cents a day in order to meet it. Our high tuition is, moreover, sending young men more and more to the other less expensive collegiate institutions. Many of these take the full courses of study there, but there is a large and increasing number who for reasons of economy replace the first year or first two years of the institute course by corresponding work at another institution, and then enter the second or the third year of the institute. There is involved in this plan a lack of continuity and of adequate preparation which is unfortunate.

While we are not interested in bringing about any large increase in the number of our students, we are concerned in drawing to us young men of the highest quality. We must, therefore, not permit the financial resources of applicants to be the principle of elimination in any greater measure than is absolutely essential. There is, in my opinion, no form of educational expenditure which produces so large a return to the community as the higher training for the scientific and engineering professions of those comparatively few young men whose character and ability are such as to enable them to rise to positions of leadership. And this type is, I believe, most commonly developed among families which have sufficient means to send their sons to the high school, but yet have trained them to work in the summers and at other odd times to earn money towards their own support. Boys from poorer families are unfortunately not likely to have the opportunity of even a high-school education or the home surroundings or antecedents which conduce to intellectual development, while those from richer families are apt to lack the earnestness of purpose and inclination to subordinate the pursuit of pleasures to thorough preparation for a life of service which is acquired by the boy who has already learned to work. It is, however, just such families of small means which are finding it exceedingly difficult, if not impossible, to meet the high expense of technological education.

This difficulty may be met in either of two ways—by a general reduction of our tuition fee or by providing larger funds for scholarship aid to individual students. Under the existing conditions a combination of the two methods seems most advisable. To reduce our tuition fee for all our students would involve such a large reduction of our income that it probably can not be immediately considered; but it might be practicable to adopt the plan of reducing the tuition fee for first-year students. The advantages of this reduction in tuition for first-year students are proportionally far greater than a corresponding reduction for those of the higher years —desirable as the latter is. It would enable a larger number of properly prepared students to enter the institute; and the most deserving of these, after they had demonstrated their ability by their first year's work, could be assisted to continue

by grants from our scholarship funds and those of the state, which can not be awarded with proper discrimination to boys in advance of their coming to the institute. Moreover, as the student gets older and has had more training, it is easier for him to get remunerative employment in the summer vacations. It will, too, diminish the tendency for students to go to other institutions for a single year or two merely for reasons of economy. Finally it is the most equitable and from a financial standpoint the safest one for the institute to pursue in effecting a reduction of its tuition charges, since the first-year instruction is less costly than the more specialized instruction of the higher years. This plan would, however, remedy only in part the difficulties of our high tuition; for our scholarship funds are not adequate to meet the needs of our deserving students in the higher years. This is fairly evident merely from the statement that the scholarship grants to undergraduate students formed last year only nine per cent. of the total tuition fees paid by them. Ampler funds must, therefore, be secured either through an appeal to the generosity of private donors or through further grants from this commonwealth, which can not afford to allow the opportunity of a higher technological education to remain closed to such of its youth as are fully qualified to receive it.

REQUIRED SUMMER WORK

Coming now to matters more closely related to the work of instruction, I would first bring to your attention the extension of the required work of the institute courses for a period of four or five weeks into the summer. Such an extension can best be made, not by lengthening our present term, but by providing summer schools which our regular students are required to attend and to which they will be admitted free of charge, in the summers at the end of the first two school years. The importance of this extension of our regular work can be fully appreciated only by those who are intimately acquainted with the difficulties and defects of our present system of instruction; but the main aspects of this matter can be readily understood. The educational problem of the institute, as has already been stated, is to give to students with only a high-school preparation a liberal education, a thorough training in fundamental scientific subjects, and sufficient technical knowledge to enable them to enter at once upon the practise of their profession. Under the present conditions, as I have already said, we must for most of our students attempt to do this as far as possible in a period of four years. The opportunities of the four-year period have, however, not yet been fully utilized. Our summer vacations form one third of the whole year; and during this time most of our younger students are unoccupied or are at work in places from which they derive no educational advantage. The assignment of even four or five weeks of the summer vacations after the first and second years to those portions of our work which consist largely in the acquirement of technical skill and experience, such as laboratory practise, shop-work, drawing and work in the field and in industrial establishments, would so relieve the present overcrowded curriculum that an amount of good entirely out of proportion to the time gained could be accomplished. The time gained would, I am sure, be devoted by the faculty not to further specialization in the engineering branches, but to some increase in general studies and to more thorough training in the fundamental principles of the sciences underlying the professional work. The attempt would be made to concentrate the attention of the student upon fewer subjects at one time, to demand more thought and less learning

of lessons, and to emphasize important principles through the solution of numerous problems by the student. The pressure of the studies of the school year would be somewhat diminished; while the work of the summer school, being largely in laboratory, shop or field, and concentrated upon one or two subjects, would not continue the mental strain to any great extent. The plan would involve increased expense to the institute; for it would be necessary to pay the salaries of the instructors engaged in the summer schools for an additional month. Aside from this, the only important objection to it seems to be the added tax that it imposes upon the resources of certain students in forcing them to meet the expenses of living in Boston for a longer period and in shortening the time which they can devote to remunerative work. This makes it, in my opinion, out of the question to charge an additional tuition fee for such required summer courses; but this is not a sufficient argument for postponing a step which is so essential to the effectiveness of our work.

INVESTIGATIONS BY THE INSTRUCTING STAFF

An extension of opportunities for investigation both in pure and in applied science by members of our staff and by advanced students is a matter which, though secondary to the considerations directly affecting the instruction and general welfare of undergraduate students, is nevertheless of the greatest importance in its effect on the relation of the institute to the scientific and technical development of this country. It ought to be our especial aim to get into the closest touch with the scientific problems of the manufacturer and the community, and to assist in the solution of them. Professors and instructors on our staff are already doing a vast amount of work in this direction, partly through the thesis work of students, and partly through their own employment as experts. But this work is often performed under conditions which make a thoroughgoing investigation impossible; and, because of its personal character, it fails to be identified with the institute and recognized among its contributions to scientific progress. In my opinion, we should in all departments give each of our assistants and instructors a reasonable proportion of free time for research purposes, we should afford him adequate laboratory facilities, and should then insist as a condition of his promotion and advancement in salary that he make and publish scientific or technical investigations. Almost all our instructors already have some available time that could be devoted to research work, so that the carrying out of this suggestion does not involve a proportionate increase in our staff. That time is, however, at present so limited, so disconnected, and so apt to be encroached upon by other work, that the man feels little encouragement to enter upon an investigation. If that amount of time could be increased and made definite by the assignment of days or half-days for research work, there would result not only an incalculable gain to himself as a teacher, investigator and scholar, but also added reputation to the institute because of its larger contributions to science.

ESTABLISHMENT OF RESEARCH LABORATORIES

Another method of promoting investigation work at the institute is through the the establishment of research laboratories in connection with the departments. For each such laboratory an income of about $5,000 needs to be guaranteed for at least a few years. Two laboratories have already been started which are devoted to research in physical chemistry and in sewage disposal, and their contributions to pure science in the one case and to questions of municipal sanitation in the other

have attracted much attention throughout the country. The formal organization of research laboratories accomplishes much more than the same expenditure of money for uncorrelated investigations by the individual members of the departments. It calls attention to the activity of the institute in this field, raises its scientific standing, attracts advanced students, who are often just as effective research workers as inexperienced assistants, offers facilities and inducements for advanced study and investigation to our younger instructors, and forms a nucleus of development in this important direction.

SCIENTIFIC BOOKS

American Philosophy: The Early Schools. By I. Woodbridge Riley, Ph.D. New York, Dodd, Mead and Co. 1907. Pp. x + 595.

This substantial volume, the fruit of the author's three years' tenure of the Johnston research scholarship in Johns Hopkins University, constitutes the achievement of the first and most difficult part of an important undertaking, the neglect of which hitherto has been a reproach to American learning. That none have before attempted, on any adequate scale, the task which Dr. Riley is carrying through is perhaps partly due to a common impression that a history of earlier American philosophy would necessarily have the brevity of the chapter on snakes in Iceland. The first of the services rendered by the present publication is that such an impression can not well continue to prevail, in view of the evidence now given of the existence of much vigorous and independent activity in speculation and scientific inquiry even in the eighteenth century. But it has always been reasonably apparent that some sort of intellectual processes must have been continuously at work in American life from the time of the founding of the earliest colleges down to the present. Yet, in spite of a considerable literature of books and monographs on special topics, we have thus far had nothing that was properly entitled to be called an intellectual history of America—a history based on an extensive collation and first-hand study of the sources, and covering the intellectual movements of all parts of the country. The nearest approach to this hitherto has been the work of a Dominican scholar, written in French. Such a history Dr. Riley, however, has undertaken to provide. It is (what is still a thing sufficiently uncommon amongst us) an *œuvre de longue haleine* that he has proposed to himself; the present volume, which leaves off at the foreshadowings of transcendentalism, is designed to be followed by two others. What distinguishes this part of the work is the novelty of much of the material, and the thoroughness with which the author has documented himself for his task. He even seems to have read through the whole series of Harvard Dudleian lectures on natural religion since 1755—a sort of cruel and unusual punishment which one might almost have supposed contrary to law in these mild days.

The interest of the book is, of course, more historical than philosophical; but it is by no means merely antiquarian. The author has, perhaps, found no American philosopher to whose writings many are likely to resort for the solution of contemporary problems. But he has rescued from oblivion some writers whom it is still possible to read with pleasure, and he has set forth, convincingly for the most part, not merely the vicissitudes of philosophical opinion—especially in academic circles—in America, but also the causes of those vicissitudes. A large part of the book may, indeed, be regarded as a record of the rise and fall of the scientific spirit and of intellectual vitality in the colleges. It is, in the main, a melancholy story of the triumph of obscurantism and mediocrity, of the suppression of ideas and the defeat of tendencies which were destined, after all, to be recalled from their graves and to exercise a powerful influence upon the university teaching of a later generation. Thus, in the first half of the eighteenth century there was an interesting development, in Johnson and Edwards, of philosophical idealism, which, like the doctrine of the Cambridge and Oxford Platonists from which it was, in the main, descended, showed

a marked tendency towards pantheism. Though Johnson's books were used as texts in King's College and the Academy in Philadelphia, his theories were born out of due time and soon perished of general neglect. Again, one hundred years ago Philadelphia and the south seemed—much more than New England—to be full of promise of great and rapid intellectual progress. As a result of the impetus given in the one case by Franklin and in the other by Jefferson, the universities and medical schools in these communities abounded in bold speculations, in openness of mind towards new hypotheses, in enthusiasm for experimental investigation, in liberal educational policies, in an especial alertness to psycho-physical problems, and in materialistic tendencies which, however open to objection on metaphysical grounds, created an atmosphere favorable to the physical and biological sciences. So we find Joseph Buchanan, in Kentucky, approximating the theory of continuous evolution from the inorganic to man, arguing for epiphenomenalism, and investigating the physiological antecedents of mental processes; we find Cooper, at the University of Virginia, elaborating a "psychology without a soul," propounding the hypothesis of the electrical character of the transmission of the nerve-impulse, and anticipating positivism; we find Benjamin Rush, at the University of Pennsylvania, lecturing systematically on the relations of mind and body, experimental psychology, abnormal psychology and psychological esthetics. Crude and one-sided these developments often were; but the spirit, and the conceptions of scientific method, that lay behind them, if they had continued to rule in American universities, would have put science and education in this country, and especially in the south, thirty or forty years ahead of their present position. These possibilities, however, soon came to naught—partly because the public mind was not ready for such ideas, partly because of the clerical power in the colleges, and largely, Dr. Riley seems to think, because of the intellectually deadening influence of the "common-sense" system of the Scotch school, which, established at Princeton early in the nineteenth century, gradually became the ruling American philosophy, as that college rose to dominance in the middle and southern states.

There are (naturally enough in so extensive a study) several minor slips that should be corrected in a subsequent edition. By an odd anachronism, Thomas Cooper (1759–1840), the son-in-law of Priestley and first professor of natural science in the University of Virginia, is confused (pp. 294, 408) with the celebrated chartist of the same name (1805–1892). It would have been a matter of some metaphysical difficulty to have been a "former chartist" in 1819. Less explicably, Priestley himself is referred to as "the great chartist." The Bridgewater Treatises can not (p. 17) have been "relegated to the back shelves" in "the latter part of the 18th century," since the earliest of them came out in 1833. The year 1797 should not be placed (p. 318) in the "era of good feeling"; the period traditionally so called came twenty years later, while the beginning of the first Adams's administration was an era of uncommonly bad feeling. Channing was in no sense a pantheist; and his Dudleian lecture of 1821 has exactly the opposite purport to that ascribed to it (pp. 207, 208). It tends to confusion to call the philosophy of Wolff (p. 320) and that of the enlightenment generally, "illuminism"; that term already has two fairly definite (and incongruous) meanings and it is not desirable that it should acquire a third. Jefferson, in the argument outlined (p. 276), so far from "desiring to give *gain de cause* to the disciples of Ocellus, Timæus, Spinoza, Diderot and D'Holbach," is engaged in refuting the atheistic philosophy which he conceives to be represented by those names. The chapter on Jefferson, in general, seems a little confused and ill-arranged; the precise character of his eventual metaphysical opinions does not altogether plainly appear. Jefferson inclined (with some agnostic hesitancy about adopting any metaphysical opinion at all) to (*a*) the doctrine that all substance is corporeal and that thought is somehow an attribute or function of body—*i. e.*, a materialistic monism; and at the same time (*b*) to the rejection of a purely mechanistic philosophy of nature,

and the affirmation, on the basis of the argument from design, of the necessity of referring the origination of the world to an intelligent mind—*i. e.*, an optimistic deism. It was implied in this that God must in some sense also be corporeal. Now, this peculiar combination of ideas was characteristically that of Priestley; and (as Dr. Riley neglects to point out, in his account of the sources of Jefferson's ontological notions) the Virginian's language plainly shows that he took over this combination, and the arguments for it, from Priestley, ready-made. The author's use of the term "deism" (to which movement a whole section of the book is devoted) is confusing and inconsistent. It would take too long to discuss here the historically correct and the incorrect uses of the word; but it is surely absurd to classify equally as "deists" such strange bed-fellows as Berkeley, Bishop Butler, Cotton Mather, Addison, Charles Chauncey, Channing, Toland, Ethan Allen and Thomas Paine. These men, between them, represent all possible attitudes upon all the issues with which the term "deism" has been associated: natural *vs.* revealed religion, pantheism *vs.* transcendence of the deity, optimistic *vs.* pessimistic view of nature, uniformity of natural law *vs.* miracles and special providences, inherent dignity *vs.* natural depravity of man. There can be no possible ground for the application of a common name to such an incongruous collection. Finally, it is rather unfair to dismiss as "puerility" a passage in which an otherwise unknown eighteenth-century writer, Thomas Dobson (p. 239), points out, concisely and clearly, just that fundamental fallacy in the then popular argument from design which Clifford, many years after, still thought it worth while to explain at some length.

But though open to criticism upon these and some other details, the book as a whole is a thorough and scholarly piece of research in a territory where the author has often been obliged to blaze his own way, and a notable addition to our historical literature. It will be indispensable to all who are interested in the history of philosophy, of natural science, of education, of religious movements, of literature, and of public opinion in America.

A. O. Lovejoy

SOCIETIES AND ACADEMIES

THE WASHINGTON ACADEMY OF SCIENCES

The Washington Academy of Sciences at its annual meeting, January 16, elected the following officers for 1908:

President—C. D. Walcott.

Vice-president representing the Anthropological Society—W. H. Holmes.

Vice-president representing the Archeological Society—J. W. Foster.

Vice-president representing the Biological Society—L. Stejneger.

Vice-president representing the Botanical Society—T. H. Kearney.

Vice-president representing the Chemical Society—F. W. Clarke.

Vice-president representing the Society of Engineers—A. P. Davis.

Vice-president representing the Entomological Society—A. D. Hopkins.

Vice-president representing the Society of Foresters—Gifford Pinchot.

Vice-president representing the Geographic Society—Willis L. Moore.

Vice-president representing the Geological Society—Geo. Otis Smith.

Vice-president representing the Historical Society—J. Dudley Morgan.

Vice-president representing the Medical Society—Henry D. Fry.

Vice-president representing the Philosophical Society—J. F. Hayford.

Corresponding Secretary—Frank Baker.

Recording Secretary—J. S. Diller.

Treasurer—Bernard R. Green.

Manager, Class of 1910—Bailey Willis.

Managers, Class of 1911—L. O. Howard, O. H. Tittmann, B. W. Evermann.

Under the auspices of the academy the president of the Anthropological Society of Washington, Dr. Aleš Hrdlička, delivered the annual address at Hubbard Memorial Hall, February 11, on "Physical Anthropology and its Aims."

The fiftieth meeting of the Washington Academy of Sciences was held at Hubbard

Memorial Hall, February 17, 1908. Dr. L. A. Bauer presided.

Professor Wallace C. Sabine, of Harvard University, delivered an address on "Some Phases of Architectural Acoustics."

The lecture hall of the Fogg Art Museum erected in 1895 was modeled after Sanders Theater in Cambridge, but failed to duplicate its excellent acoustic properties. This misfortune led the corporation of Harvard University to request Professor Sabine to investigate the matter and propose changes to remedy the difficulty.

It has been claimed by some that to secure good acoustic properties the dimensions of the room should be as 2:3:5 or similar proportion, or that the room should be elliptical, but the best and the worst auditoriums in Cambridge are both semicircular, indicating that it is by no means a matter of proportion or shape alone.

The acoustic properties of a hall involve four principal factors: distributed loudness, reverberation, resonance and interference. To adjust these four physical characteristics there are two variables, the form of the auditorium and the material of which it is constructed. The essential features of the material are its absorbing and reflective powers. Through a measurement of the reverberation it is possible to determine the absorbing and therefore the reflecting powers of a wall surface. The method of so doing was explained at some length, and the results of such measurements given.

With an organ pipe as a constant source of sound and a chronograph to record its duration after the wind was cut off, the audibility of the residual sound, the reverberation, in the lecture hall of the Fogg Museum was found to be 5.62 seconds—a condition which rendered the room intolerable as an auditorium. By putting Sanders Theater cushions upon the seats, floor and part of the wall of the lecture hall, the duration of the residual sound was reduced to 1.14 seconds. The absorbing power of these cushions was ultimately compared with that of an open window. The absorbing power determined for a few of the kinds of wall surface and of an audience are given below, expressed in square meters of open window.[1]

Hard pine wood sheathing per square meter	.061
Plaster on wood lath per square meter	.034
Glass—single thickness—per square meter	.027
Audience per square meter	.94
Isolated woman	.54
Isolated man	.48
Cretonne cloth per square meter	.15
Hair felt 2.5 cm. thick and 8 cm. from wall per square meter	.78

As a result of two years' investigation felt was placed on particular walls of the lecture hall in the Fogg Museum; so the room was rendered, not excellent, but entirely serviceable and has since been used without complaint.

With a number of given and determined factors Professor Sabine treated the subject mathematically and showed that knowing the absorbing power of the wall bounding surfaces and the dimensions of the auditorium it is possible to calculate with accuracy the reverberation if need be in advance of construction. Several examples of such calculations were given. The paper up to this point having dealt entirely with middle C, was then extended to a discussion of the whole range of the musical scale. Examples were given showing the absorbing power of wall surfaces for notes of high pitch.

Mr. Bernard R. Green, discussing the paper, remarked upon the difficulty of killing echoes and inquired as to the facts concerning the Mormon Tabernacle.

Professor Sabine replied that he had made a special journey to Salt Lake City to study the acoustic properties of the tabernacle, and found that its excellence in that respect was not a matter of "inspiration." When first built the acoustic properties were very poor. Attempts were made to remedy the difficulty by stretching wires across the room and hanging curtains, but they were of no avail. Finally, the increasing size of the congregation necessitated the construction of a gallery, which unexpectedly corrected the acoustic defects.

[1] *American Architect and Building News*, Vol. 68, pp. 3, 19, 35, 43, 59, 75 and 83.

Mr. C. K. Wead expressed his high admiration for the ingenuity of the methods used by the lecturer, the monumental patience with which the laborious experiments were carried out, and the skill with which the data have been discussed.

The ordinary man, and even the architect, generally assumes that sound-waves in a room which is only a few wave-lengths long, can be treated like light-waves; but the case is one of diffraction rather than of rectilinear propagation and of reflection by the laws of optics.

A merit of Professor Sabine's work is that he has been able to make a sort of summation of the complex phenomena in all parts of a room. His immediate result—the reverberation, or the number of seconds the sound can be heard after the wind is cut off from his standard organ pipe—is not in itself of any value; but like the percentage of carbon dioxide in the air, which was considered before the days of bacteriology to gauge the impurity of the air, this duration can be measured and it gives information about quantities far more important than itself.

J. S. Diller,
Recording Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 199th meeting of the society, held at the Cosmos Club, on Wednesday evening, January 22, the following papers were presented.

Regular Program

Deposits of Residual Iron Ore in Cuba: A. C. Spencer.

In Cuba a great part of the deep residual soils are highly ferruginous and in many localities so rich in iron as to constitute usable ores of that metal. Three districts, passing under the names Moa, Mayari and Cubitas, were described in which very large tonnages of such iron ore exist.

Certain features of the deposits are very like those of the high level laterite of India, especially the occurrence of a deep bed of yellow clay next to the basement of solid rock and the common gradation of the yellow clay into red earthy material, containing pisoliths and irregular concretions of brown iron oxide which are locally cemented into continuous but porous layers.

In one of the regions named the combined thickness of these materials varies from a few feet to more than fifty feet, and a large number of analyses have proved that both the ochreous clays and the material lying above them contain on the average about 46 per cent. of iron when dried at 212° F., so that all of the residual material is to be considered as ore. In its natural state the ore carries above 40 per cent. of water of which about 13 per cent. is said to be combined. Alumina is present in excess of the amount required for combination with the silica and is doubtless present in the form of hydrated oxide. Phosphorus is uniformly low, averaging less than .02 per cent. and chromium is always present, the average amount being somewhat less than two per cent.

The fact that chromium is characteristic of the ore is regarded as definite proof that the material has been derived from the serpentine which constitutes the underlying rock in each of the three fields.

The absence of discrete particles from the material is taken as an indication that no part of it is transported, and as strongly suggesting its accumulation in situ as the insoluble residuum of complete weathering and decay of the serpentine. The topography of the ore fields also favors the idea of a simple residual origin, since in each case the deposits constitute surficial mantles over extensive surfaces practically wanting in local relief. Though now uplifted and even warped, these surfaces are interpreted as the remnants of ancient peneplains upon which the sort of rock disintegration, favorable to deep residual deposits, would naturally take place. The geologic period during which this planation to base-level occurred can not be fixed but, in the mind of the speaker, is to be tentatively correlated with Lafayette and pre-Lafayette time.

Systematic chemical work is demanded by the whole problem of the genesis of these ores, but the best promise of immediate results would seem to be offered by an investigation of the variations in the state of hydra-

tion of the material from different depths in the deposits. Some analyses indicate the presence of hematite in addition to the hydrous oxides and the brilliant red of some of the clays near the surface of the ground leads to the same conclusion. Some of the pisoliths are attracted by the magnet showing that there has even been a certain amount of dehydration, unless indeed the presence of undecomposed magnetite, inherited from the original rock, can be shown.

The United States Geological Survey's Hydraulic Laboratory at Berkeley, California: G. K. GILBERT.

The laboratory has been established for the purpose of investigating in a quantitative way the laws controlling the transportation of detritus by running water. Initially it is determining the capacity of a stream of definite discharge to transport sand of uniform grain in a straight channel of definite width and definite slope. The apparatus includes special devices for measuring the quantity (discharge) of water, the velocity, and the amount of sand transported. In each experiment, while water is flowing uniformly through a long trough, sand is introduced from above at a uniform rate, and the water is allowed to arrange it on the bottom of the trough. After a time the sand surface assumes a stable slope adjusted to the maintenance of a velocity just sufficient to transport the amount of sand (load) fed to the water, and this slope is measured. In the next experiment a different quantity of sand is introduced and the resulting slope is measured. A series of such experiments yields a curve or equation of the relation between load and slope. The discharge is then changed and the work repeated. In this way, and by the progressive permutation of the controlled conditions, the laboratory is determining the elementary laws of the transportation of detritus, in relation to slope of channel, width of channel, size of sand grain, discharge, mean velocity of current, and bottom velocity.

The laboratory is in the immediate charge of Dr. E. C. Murphy. Space, power, and other important facilities are generously contributed by the University of California.

RALPH ARNOLD,
Secretary

SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

REGULAR meetings of the Society for Experimental Biology and Medicine were held on October 16 and December 18, 1907, and February 19, 1908. The scientific program of each of the meetings is appended.[1]

Twenty-fifth Meeting

College of Physicians and Surgeons, Columbia University. October 16, 1907. President Flexner in the chair.

Members elected—Edward T. Reichert, M. J. Rosenau, Richard P. Strong.

Program

"Cardiac Insufficiency due to High Arterial Pressure," by Haven Emerson.

"Effect of Potassium Cyanide upon Metabolism," by George B. Wallace and A. N. Richards.

"Pneumothorax and Posture," by Charles A. Elsberg.

"The Hypersensitiveness of the Guinea-pig to Horse Serum," by Paul A. Lewis.

"A Sporozoan found in the Peptic Glands of the Common Mouse," by E. E. Tyzzer.

"The Rôle of Tonicity in Human Isohemagglutination," by Frederick P. Gay.

"Effects of Calcium and Magnesium Salts upon the Development of Rigor Mortis," by S. J. Meltzer and John Auer.

"Restraint and Promotion of Tumor Growth," by Simon Flexner and James W. Jobling.

"Reestablishment of Function in Transplanted Kidneys," by Alexis Carrel.

"A Depressor Reaction obtainable by Traction on the Carotid Artery," by Torald Sollmann and E. D. Brown.

"A Modification of Teichmann's Method for obtaining Hemin Crystals," with a demonstration

[1]Authors' abstracts of the papers read before the Society for Experimental Biology and Medicine are published in the *Proceedings of the Society for Experimental Biology and Medicine.* A number is issued shortly after each meeting, and costs 15 cents a copy. Copies may be obtained from the managing editor, William J. Gies, 437 West 59th Street, New York.

of specimens, by James P. Atkinson and Arthur I. Kendall.

"The Influence of Ether Anesthesia on the Excretion of Nitrogen by Dogs," by Philip B. Hawk.

"The Relative Value of Antitoxin and other Curative Substances in Antidiphtheric Serum," by Edna Steinhardt and Edwin J. Banzhaf.

Twenty-sixth Meeting

Rockefeller Institute for Medical Research, New York. December 18, 1908. President Flexner in the chair.

Members elected—Edwin J. Banzhaf, William N. Berg, H. D. Dakin, Charles A. Elsberg, Shinkishi Hatai, Charles E. Simon, S. Burt Wolbach.

Program

"The Effect of Light on Cells in Fluorescent Solutions after Addition of Potassium Cyanide," by Elizabeth Cooke and Leo Loeb.

"Physiological Age," by C. Ward Crampton.

"Gastric Peristalsis after Section of the Vagi and Splanchnic Nerves," by John Auer.

"The Effect of Stimulation of the Vagus Nerves upon the Development of Rigor Mortis of the Mammalian Heart," by Don R. Joseph and S. J. Meltzer.

"The Antagonistic Action of Calcium upon the Inhibitory Effect of Magnesium," by S. J. Meltzer and John Auer.

"Remote Result of the Transplantation of a Segment of Popliteal Artery from a Man to a Bitch," by Alexis Carrel.

"Concerning the Relation of the Coagulation Time of the Blood to Thrombosis in Phlebitis," by Harlow Brooks and B. C. Crowell.

"The Reactive Power of the White Rat to Tissue Implantation" (second communication), by Isaac Levin.

"The Hemolytic Reactions of the Blood in Dogs with Transplantable Lymphosarcoma," by Richard Weil.

"On the Circulation through the Kidneys, (I.) On Vaso-motor Reactions, (II.) The Renal Blood Flow in Relation to the Pressure in the Ureter and Bladder, (III.) The Effect of Solutions of Adrenalin," by R. Burton-Opitz and D. R. Lucas.

"Some Data regarding the Portal Circulation," by R. Burton-Opitz.

"A Clinical Viscosimeter," by R. Burton-Opitz.

"Studies in Experimental Arteriosclerosis," by Isaac Adler and O. Hensel.

"On the Influence of Various Substances, Applied Directly to the Medulla Oblongata, upon the Respiratory Rhythm in Frogs," by T. Brailsford Robertson.

"Metaplasia and Metastasis of a Rat Tumor," by Simon Flexner and J. W. Jobling.

Twenty-seventh Meeting

(Fifth Annual Business Meeting)

Schermerhorn Hall, Columbia University. February 19, 1908. Vice-president Morgan in the chair.

Members elected—L. W. Famulener, C. Stuart Gager, W. S. Halsted, W. A. Jacobs, Theodore C. Janeway, Don R. Joseph, Frank R. Lillie, Alwin M. Pappenheimer, Donald D. Van Slyke.

Officers elected:

President—Frederic S. Lee.
Vice-president—Thomas H. Morgan.
Treasurer—Graham Lusk.
Secretary—William J. Gies.

Program

An exhibition of photographs of chromosomes, with explanatory comment, by Edmund B. Wilson.

"The Production of two Kinds of Spermatozoa in Phylloxerans—Functional 'Female Producing' and Rudimentary Spermatozoa," by T. H. Morgan.

"Physiological Problems of the Geographical Distribution of *Partula* in Polynesia," with demonstration of specimens, by Henry E. Crampton.

"Note on the Isolation of Carnaubic Acid from Beef Kidneys," by Edward K. Dunham.

"The Change of Corpuscle Resistance in the Blood of Immunized Animals, Coincident with the Formation of Antibodies," by Frederick P. Gay.

"Further Observations on the Precipitation of Inorganic Colloids by Sera," by Cyrus W. Field.

"A Note on Anaphylaxis," by Edwin J. Banzhaf and L. W. Famulener.

"The Relation of Plasticity to Sex and Age in the Dancing Mouse," by Robert M. Yerkes.

"The Crystallography of Hemoglobin," by Edward T. Reichert and Amos P. Brown.

"The Germicidal Property of Milk," by M. J. Rosenau and Geo. W. McCoy.

The next regular meeting will be held on April 15.

William J. Gies,
Secretary

THE TORREY BOTANICAL CLUB

The meeting for January 29, 1908, was held in the Museum Building of the New York

Botanical Garden at 3:30 P.M. Vice-President Barnhart presided and there was an attendance of thirty-four.

The secretary presented the report of Mr. Percy Wilson, chairman of the field committee, for 1907. Twenty-five field meetings were reported scheduled through the months of May to October, inclusive, though a few of these meetings were not held, on account of inclement weather.

Biographical résumés and appreciations of Professor Underwood's life and work were read as follows:

"A Biographical Sketch of Lucien Marcus Underwood," by Carlton C. Curtis.

"Lucien Marcus Underwood: A Memorial Tribute," by Marshall A. Howe.

"The Published Work of Lucien Marcus Underwood," by John Hendley Barnhart.

"Professor Underwood's Relationship to the Work of the New York Botanical Garden, together with the Preamble and Resolutions on Professor Underwood's death, adopted by the Scientific Directors of the Garden," by N. L. Britton.

The above papers were published in full in the January, 1908, number of the *Bulletin of the Torrey Botanical Club.*

The following resolutions, presented by a committee of the club, were read and unanimously adopted:

In the death of Lucien Marcus Underwood American botany has lost one of its foremost representatives, one who was exceptionally free from prejudice and selfishness and who abhorred all superficiality and obsequiousness. The Torrey Botanical Club has lost a faithful officer and a zealous and enthusiastic supporter of all its activities and interests.

We desire to pay tribute to his superior qualifications and attainments as a man of science, and to express our profound sorrow as we attempt to realize that we shall no more feel the warm clasp of his hand, meet the glance of his sympathetic eye, or hear his cheering words of counsel and encouragement.

The Torrey Botanical Club hereby directs that this minute be entered in its proceedings and duly published with them.

C. STUART GAGER,
Secretary

THE AMERICAN MATHEMATICAL SOCIETY

THE one hundred and thirty-seventh meeting of the society was held at Columbia University on Saturday, February 29, extending through the usual morning and afternoon sessions. Thirty-four members were in attendance. President H. S. White occupied the chair, being relieved at the afternoon session by Professor P. F. Smith. The following persons were elected to membership: Mr. E. G. Bill, Yale University; Mr. C. H. Currier, Brown University; Mr. W. S. Pemberton, State Normal School, Edmond, Okla.; Professor S. W. Reaves, University of Oklahoma; Mr. L. L. Silverman, University of Missouri; Mr. W. M. Smith, Lafayette College; Mr. H. W. Stager, University of California. Twelve new applications for membership were received.

The by-laws of the society were amended to provide that a member of the editorial committee of the *Transactions* should be appointed each year at the April meeting of the council and should take office on the following October 1.

The usual informal dinner was arranged for the evening and was attended by twelve of the members.

The "Annual Register" of the society, containing list of officers and members, constitution and by-laws, catalogue of library, etc., has recently been issued. Copies can be obtained from the secretary.

The following papers were read at the February meeting:

R. D. CARMICHAEL: "On the numerical factors of certain arithmetic forms."

R. D. CARMICHAEL: "On the remainder term in a certain development of $f(a+x)$."

F. R. SHARPE: "The Lorentzian transformation and the radiation from a moving electron."

VIRGIL SNYDER: "Normal curves of genus 6 and their groups of birational transformations."

J. W. YOUNG: "The geometry of chains on a complex line."

J. W. YOUNG: "A fundamental invariant of discontinuous ζ-groups defined by a normal curve of order n in space of n dimensions."

E. B. VAN VLECK: "On non-measurable point sets."

L. E. Dickson: "On higher congruences and modular invariants."

Max Mason: "Note on Jacobi's equation in the calculus of variations."

G. W. Hill: "Subjective geometry."

G. A. Bliss: "A method of deriving Euler's equation by means of an invariant integral."

C. N. Haskins: "On the second law of the mean."

Edward Kasner: "The contact transformations of mechanics."

Edward Kasner: "The plane sections of an arbitrary surface."

G. A. Miller: "Note on the periodic diurnal fractions."

F. R. Sharpe: "The inner force of a moving electron."

W. H. Roever: "Brilliant points of curves and surfaces."

Frank Irwin: "Transformations of the elements x, y, y', $\cdots$, $y^{(k)}$ that carry a union of such elements over into a union."

The San Francisco Section met at Stanford University also on February 29. The Chicago Section will meet April 17–18. The next regular meeting of the society will be held on April 25. The summer meeting will be held at the University of Illinois, September 10–11.

F. N. Cole,
Secretary

DISCUSSION AND CORRESPONDENCE

LAFAYETTE DEPOSITS IN LOUISIANA

To the Editor of Science: In your current number (February 28, 1908, page 351) Professor G. D. Harris suggests assigning the Lafayette formation to the Pleistocene, rather than the Pliocene, on the basis of associated fossils brought up in borings from depths of 1,500 feet or more. In this connection it is worth while to consider the alternative hypothesis that the beds tapped by the drill in southern Louisiana are redeposited Lafayette materials rather than original deposits. It is to be noted as tending to favor the alternative hypothesis that the Lafayette deposits are made up of residuary products gathered from the interior and laid down along shore (with little admixture of other material) during a period of continental depression, the distribution having been effected by river currents or wave action, or by both combined; so that it seems improbable that materials of this distinctive type could have been deposited far off-shore, and especially at depths of 2,000 feet or more—for to the depth of the boring noted by Professor Harris must be added the 500 or more feet of subsidence during the Lafayette period. It is also to be remembered that among the striking features of the Lafayette formation is its extensive erosion, especially in the Mississippi embayment: From a latitude above the mouth of the Missouri to the gulf the formation has been completely removed over an area averaging 50 to 75 miles in width, aggregating fully 40,000 square miles—*i. e.*, about one eighth of the total area of the formation above present tide level. Moreover, it seems certain both from evidence of remnants and from physical considerations that this was the thickest portion of the formation; so that in this district something like a fifth of the aggregate volume of the deposits must have been eroded away, largely during the post-Lafayette high-level period when that portion of the continent about the present mouth of the Mississippi stood a thousand feet or more above its present level. During this high-level period the Lafayette materials might well have been redeposited at what was then a limited depth below the surface of the gulf, with little admixture of foreign matter. Such an association would be quite consistent with Professor Harris's paleontologic evidence; and it has the advantage of consistency both with the physical conditions attending the genesis and partial degradation of the formation, and with the stratigraphic relations found farther in-shore both in the Mississippi Valley and along the middle Atlantic slope.

W J McGee

A HANDY SUBSTITUTE FOR THE BLAST BLOWPIPE IN BLOWPIPE ANALYSIS

It occurred to me that the small rubber bulb which is used to furnish the atomized alcohol for the platinum tip in an ordinary pyrography outfit, might profitably, where there is no equipment for tapping a compressed air

chamber, be employed for a continued blast in blowpipe analysis.

A very satisfactory test was obtained by attaching the rubber tube of a medium-sized bulb immediately to the blowpipe and using the muscular contraction of the hand instead of the cheeks—much to the relief of the latter. The strength of the blast was surprising. A strong oxidizing flame of about two inches could be secured easily and with a small amount of gas-supply and one filling of the bulb, a steady flame was given for more than a half-minute. A larger size foot-apparatus proved much more powerful. The only difficulty was that it was not easy to make a small reducing flame. For handy and continuous work with difficultly reducible minerals—shortening many processes very much—and in giving the instructor an opportunity to teach during his personal blowpipe instruction, it has considerable practical value, besides doing away with the necessity of bringing the lips into contact with the blowpipe.

CHARLES W. BROWN
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BROWN UNIVERSITY

SPECIAL ARTICLES

TRANSPLANTATION OF FORMALDEHYDE-FIXED BLOOD VESSELS

IT has been demonstrated that segments of blood vessels may be transplanted successfully from one species of animal into another, *e. g.*, cat or rabbit into dog.[1] Consideration of these results led me to transplant segments of blood vessels that had been preserved in some fixing solution.[2]

In the case here reported abdominal vena cava of dog preserved in 2.5 per cent. formalin (in 0.9 per cent. NaCl) for 60 days was used. The day before the operation the segment, which was about 0.75 cm. long and 0.5 cm. in diameter, was removed from the formalin solution, washed in dilute ammonia, dehydrated in absolute alcohol and impregnated with paraffine oil. It was interposed between and sutured to the cut ends of the right common carotid artery of a medium-sized bitch. The diameter of the artery was considerably less than that of the venous segment.

The animal made a rapid and uneventful recovery, the wound healing promptly. Clinical examination 22 days after the operation revealed a strong pulsation on the course of the artery at the site of the transplanted segment. The following day the neck was opened and the vessel directly examined. The segment was found to be about 1.5 cm. long and .75 cm. in diameter. It pulsated strongly and the circulation through it was excellent. The walls appeared to be slightly thickened but pliable. In appearance it resembled similar segments transplanted immediately after removal. The wound was closed and the animal returned to its cage. No histological studies have as yet been made, but material is being accumulated for that purpose.

Conclusion.—A segment of dog's abdominal vena cava preserved in formaldehyde for two months and then interposed between the ends of a dog's carotid artery may adequately serve the mechanical function of an artery for more than three weeks.

C. C. GUTHRIE
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WASHINGTON UNIVERSITY,
ST. LOUIS, MO.

[1] Carrel, *Journal of Experimental Medicine*, IX., p. 226, 1907; Guthrie, *American Journal of Physiology*, XIX., p. 482, 1907; Guthrie, *Proceedings American Physiological Society*, 1907.

[2] Guthrie, *American Journal of Physiology*, XIX., p. 486, 1907.

A DROUGHT-RESISTANT HICKORY

WHILE investigating the distribution of the hickories in western Arkansas, in behalf of the federal forest service, the writer recently had occasion to note the drought-resistant quality of a little-known member of the genus—a variety probably most closely related to *Hicoria glabra* var. *odorata* Sarg.[1] This form

[1] The form occurring in Arkansas does not seem to conform closely either to *H. glabra* var. *odorata* Sarg. or to *H. villosa* Ashe. The writer, however, strongly disapproves of the publication of any new species, or even varieties in this genus, until the limits of present accepted forms be more accurately established.

occurs in great abundance on the dry flinty hills of the Ozark region, where it is associated with black-jack and post oaks, and with white hickory. Both of these hill hickories are known locally as "bull hickory," there being very little to distinguish them except the foliage. The *glabra* form is the commonest tree in the hills, where it is usually rather small—occasionally twelve inches in diameter and fifty feet high—with very thick, rough bark separating into small squares like the proverbial alligator hide; a rather deep cylindrical crown of small branches, and small, lanceolate, shiny leaflets.

The reproduction of this "alligator hickory" is very good, and is especially abundant on hills which are burned over every year, these being sometimes covered with nearly pure thickets of hickory seedlings and seedling-sprouts. These are injured less by the burnings and recover more readily than the small oaks, afterward, and hence are the sole survivors where fires occur frequently. Examination of the seedlings, however, shows them to be very old, and proves beyond a doubt that their development is very much retarded by the exposure.

The drought-resistance of this hickory is even more remarkable than its fire-resisting powers. After a midsummer drought of eight weeks, both the black-jack and post oaks were in very bad condition, a large proportion of the foliage having turned brown, or the trees killed outright. The hickory, on the other hand, showed only a slight deadening of the leaves in the tops of a few trees. The explanation of this superior drought-resistance is undoubtedly to be found in the small, thick-skinned leaves which characterize the alligator hickory, and which are typical of xerophytic plants. The tendency to form a long, strong tap-root, which all hickories exhibit when growing in well-drained soil, is certainly a very potent factor here.

Such characters as these recommend the alligator hickory for planting in the prairie states, and in dry situations in more humid regions. The high technical value of the wood should in part offset the very slow growth of the tree. It is not to be expected that the hickory will attain to merchantable size in less than seventy to one hundred years. In that period it should produce a considerable quantity of spoke and handle stock of the very highest quality, if grown on soils of reasonable strength. The planting of hickory on light soils can not be recommended under any circumstances.

C. G. Bates

U. S. Forest Service,
Washington, D. C.

Current Notes on Meteorology and Climatology

Kassner's Meteorological Globes

Professor C. Kassner, of the Prussian Meteorological Institute and also of the *Technische Hochschule* in Berlin, has prepared two "meteorological globes" which will be of great help to teachers of geography in general, and especially to those who lay much emphasis on meteorology and climatology. These globes (diameter 34 centimeters) show, for January and for July, the temperature, pressure and winds of the world. The temperature is shown by isotherms for every 2°, and in places for every 4° C.; the isotherm of 0° C. is drawn heavier than the others; those parts of the globe which are warmer than 0° are colored red, and those colder than 0° are colored blue. Different shades of red and blue are used for different degrees of heat and cold. Isobars are drawn in blue, the isobar of 760 mm. being heavy; those below 760 mm. are broken lines; those above, solid lines. Winds are indicated in the usual way by arrows. The principal meteorological stations the world over are shown; the observatories, and the central stations of the various meteorological services are appropriately emphasized by special symbols.

By an ingenious device the globes can be turned over, while still remaining on their wooden stands, so that the southern latitudes may be readily seen. These globes will help greatly in giving a clearer conception of the actual distribution of temperatures, pressures and winds than can be gained from a study of the ordinary meteorological charts. While the globes are too small for exhibition

purposes before large classes, they can be used in work with small classes with excellent results. The price is 50 Marks; the agent, Dietrich Reimer (Ernst Vohsen), in Berlin. There have been few additions to the teaching equipment in meteorology and climatology in recent years which are of more value than Kassner's meteorological globes. It is to be hoped that many of them will find places in our geographical laboratories, both in schools and in colleges.

WATERSPOUTS ON THE SWISS LAKES

PROFESSOR J. FRÜH has recently published an interesting paper on the waterspouts of the Swiss Lakes ("Wasserhosen auf Schweizerseen," *Jahresber. geogr.-ethnogr. Gesells. Zürich,* 1906–07, 105–127), in which a detailed account is given of the waterspout of June 19, 1905, on the Lake of Zug. This spout was 18–20 meters in diameter, and stirred up the waters of the lake within an area of 100 meters, more or less. The whirling column was hollow; had a left-handed rotation; was more than half a mile high. Its velocity of progression was somewhat over seven miles an hour, in an easterly direction. Several photographs were taken of this waterspout, three of which are reproduced in Professor Früh's article. The author has also collected accounts of what he believes to be well-authenticated waterspouts observed on the Swiss lakes. There are 22 in all, noted on nine lakes. Of these waterspouts, all were observed by day, and 14 of the 22 occurred in the (meteorological) summer. There is no evidence of any value to the effect that any of these spouts were produced by the meeting of winds coming from different directions.

A HYGROSCOPE OF A UNIQUE PATTERN

IN *Symons's Monthly Meteorological Magazine* for November, 1907, John Aitken describes a simple hygroscope which he has used for many years. The petal of one of the so-called everlasting flowers is attached to a stiff hair, which serves as a pointer, and the petal and hair together are fastened on a dial, set in a metal case. The instrument is about as sensitive as a hair hygroscope; is more compact, and much cheaper. An illustration shows the construction of the hygroscope.

R. DEC. WARD

HARVARD UNIVERSITY

THE FIRST INTERNATIONAL CONGRESS FOR THE REPRESSION OF ADULTERATION OF ALIMENTARY AND PHARMACEUTICAL PRODUCTS

THE First International Congress for the Repression of the Adulteration of Alimentary and Pharmaceutical Products will be held in Geneva in September, 1908. As described in the preliminary statement issued by the congress, it has been felt for many years that such a movement was desirable and necessary, but more general matters occupied the limited time of the international congresses, and while these subjects were taken up among others, they did not receive undivided attention. The feeling that such a congress is necessary has been crystallizing for a quarter of a century, and at the Fourteenth Congress of Hygiene and Demography, in Berlin, 1907, the Universal Society of the Geneva White Cross conceived the thought of initiative action. The plan for the first meeting is an exhibition of unadulterated products, and the consideration of this occasion will be the "Defining of Unadulterated Food." In every case definition will be the basis of each decision, establishing a "codex alimentarius." It is desired by the committee of organization that manufacturers, chemists and lawyers who are interested in this question, should unite in forming these definitions.

Dr. H. W. Wiley, Bureau of Chemistry, Washington, D. C., has been asked to undertake the organization of the American committee. He hopes to associate with him those in the various states who have charge of the application of the food and drug laws, to whom he has written individually, inasmuch as these should be represented if possible as a whole. For the benefit of the chemists of the country at large, as well as others of every class who desire to identify themselves with this movement, the statutes of the congress are reproduced herewith:

Article 1.—The first International Congress for the repression of alimentary and pharmaceutical adulterations will be held in Geneva in September, 1908.

Article 2.—The congress comprises three classes of members: donors, nominal members and associated members.

1. *Donors.*—Any person having contributed the sum of at least 100 francs can take part in the congress as a donor.

These members take an active part in the work of the congress and receive its publications. Their names head the list of the members of the congress.

2. *Nominal Members.*—Any person, or body, having contributed the sum of 20 francs can take part in the congress as nominal members.

Each of the bodies entered in the category of nominal members can be represented by one or more delegates. In the latter case, the amount of the participation quota has to be paid by each of them.

The nominal members take an effective part in the work of the congress and receive its publications.

3. *Associated Members.*—All persons forming part of the family of a nominal member (wife, brothers, sisters, sons, etc.) who contribute the sum of 10 francs can be associated.

The associated members enjoy, in the same way as the nominal members, all the advantages offered by public administrations on traveling fares.

They do not receive the publications of the congress, do not take part in either the voting or the discussions and can not make any communications. They are invited to the fêtes and official receptions; they may be present at the sittings.

Article 3.—Only the regular receipts, given by the secretary general and signed by him, can secure admission to the congress, as well as delivery of the admission card and the forwarding of the publications. This card will be necessary for admittance to the sittings and for participation in the advantages offered to members of the congress. Provisory receipts, delivered by local or foreign committees are not available.

Article 4.—When sending their contribution to the secretary general, Rue du Rhône, 42, Geneva, members are requested to write distinctly their surnames, christian names, rank and address, and to enclose their visiting card.

Article 5.—Besides other advantages (particularly interesting traveling fares), and in addition to the volume of preliminary reports and résumés which will be distributed long before the opening of the congress, the donors and nominal members will be entitled to the other publications and to the reports of the congress.

Article 6.—The official languages of the congress are English, French, German and Italian.

In each country the reports to be presented at the congress must be addressed to the secretary of the delegation of said country.

Article 7.—The congress will comprise:

1. A general opening meeting.
2. Meetings of sections for the reading and discussion of reports and communications.
3. General meetings (two at most) for communications and discussions which interest the sections jointly.
4. A general closing meeting.
5. Public lectures.
6. Excursions.
7. Fêtes and receptions.

The exact program of the use of the time will be published later on.

The chairman has the direction of the sitting; he gives a member the hearing of the assembly or prevents him speaking according to parliamentary rules.

Article 8.—Not more than fifteen minutes are allowed for a reading or a speech, and the members who take part in the discussion must not speak longer than five minutes each. Speakers are requested to give, the same day, a manuscript résumé of the observations they have made in the course of a meeting to the secretary of each section.

Article 9.—The study of the questions submitted to the deliberations of the congress is divided into sections.

The committee of each of the sections will be appointed by the organizing commission, but it will be completed by the sections, so as to add foreign colleagues to the French members.

Each section will sum up its work in the form of propositions or conclusions which will be presented in a written form at the plenary sittings.

The right of amendment will not be diminished, but only such propositions as are written and sent to the committee will be discussed.

Article 10.—In its closing meeting the congress will fix the town of its next assembly.

Dr. Wiley will undertake to forward names and contributions to the secretary general, together with suggested definitions, in case intending members wish the material transmitted in this way, in order that there may be an American record of members in this

country. In case the dues are thus sent to Washington for transmission to Geneva, a check for $20 for donating members, $4 for nominal members, and $2.50 for associate members should be sent, to cover dues, exchange and postage. To those preferring to send directly, Dr. Wiley will send the blank furnished by the congress, on application. It is particularly desired that as many as are able submit definitions for food and drug products, as it is profitable to accumulate as much material as possible, to establish a broad basis for decisions.

Papers on food and drug products are also solicited, and may be sent directly to the appropriate sections or forwarded to Dr. Wiley for transmittal. It is hoped that a large membership in the congress may be secured from the United States.

RECENT REFERENCES TO LAMARCK

THE increased interest in the work of Lamarck is nowhere better evinced than in the number of Lamarckian items which one finds in current journals. In the *Revue Scientifique* (December, 1907) there appears an article on his early career, in *La Nature* (December 21, 1907) a careful study of his paternal family, in the *Journal des Savants* on some of his unpublished writings. And Dr. C. R. Eastman, of Harvard, has now brought to light a manuscript of Lamarck which has in part at least remained unpublished. This document was obtained (probably purchased in Paris) by Professor Alexander Agassiz and was by him presented (1896) to the Museum of Comparative Zoology. It consists of a series of essays, two psychological ("Système de Gall," 40 pp., "Idée et Imagination," 33 pp.), one purely philosophical ("Apperçu analytique des connaissances humaines, avec des divisions et des réflexions tendant à montrer leur dègrè de certitude, leur source, leur branches principales," 12 pp.) and three zoological ("Questions zoologiques dont la solution est de première importance," 4 pp., "Discussion sur les caractères essentiels des animaux et sur la définition qui pent les embrasser généralement," 12 pp., "Histoire naturelle" (scope of), 4 pp.). Following these are numerous drawings, doubtless from the hand of Lamarck, some in crude outline, as his "monads," some in color, of which one is a beautifully executed figure of a holothurian. At the instance of Dr. Eastman the manuscript has recently been placed in the hands of Professor Bashford Dean, of Columbia University, for detailed examination and publication.

SCIENTIFIC NOTES AND NEWS

PRESIDENT ELIOT, of Harvard University, will deliver six lectures at Northwestern University on the Norman W. Harris Foundation. His general subject will be University Administration, and the dates and titles of the separate lectures as follows: Lecture I., "The Trustees." Thursday evening, April 9, at 8 o'clock. Lecture II., "An Inspecting and Concurring body—Alumni Influence." Friday evening, April 10, at 8 o'clock. Lecture III., "The University Faculty." Saturday morning, April 11, at 10 o'clock. Lecture IV., "The Elective System—Academic Distinctions." Saturday evening, April 11, at 8 o'clock. Lecture V., "Methods of Instruction—Social Organization." Monday evening, April 13, at 8 o'clock. Lecture VI., "Administration—The University President." Tuesday evening, April 14, at 8 o'clock.

PROFESSOR W. M. DAVIS, of Harvard University, and Professor A. P. Brigham, of Colgate University, will give several lectures on "The Geography of North America" in the School of Geography to be held at Oxford University from August 10 to 28.

SIR OLIVER LODGE'S presidential address to the Faraday Society, to be given on March 24, will have as its subject "Some Aspects of the Work of Lord Kelvin."

A BANQUET has been tendered to Dr. Robert Koch by the profession in Berlin. A portrait medallion was presented him, the first of a series of medallions of prominent living German physicians.

THE following fifteen candidates have been selected by the council of the Royal Society to be recommended for election as fellows: Mr. W. Barlow, the Earl of Berkeley, Mr. Dugald

Clerk, Professor A. Dendy, Professor H. H. Dixon, Mr. J. Stanley Gardiner, Professor W. Gowland, Mr. J. H. Grace, Professor D. J. Hamilton, Mr. C. I. Forsyth Major, Mr. E. N. Nevill, Mr. W. H. Rivers, the Hon. Bertrand Russell, Dr. Otto Stapf, and Dr. J. F. Thorpe.

Among those recently elected members of the Athenæum Club, under the provision which enables the committee to elect a certain number of persons "of distinguished eminence in science, literature, the arts, or for public services," is Dr. John Rose Bradford, F.R.S., physician to University College Hospital, London, and professor of medicine in the medical school.

Officers of the London Institute of Chemistry have been elected as follows: *President,* Dr. P. F. Frankland, F.R.S.; *Vice-presidents,* Dr. M. O. Forster, F.R.S., Mr. Oscar Guttmann, M.I.C.E., Mr. Egbert Grant Hooper, Mr. David Howard, Mr. Herbert Jackson, and Sir William Ramsay, F.R.S. *Hon. Treasurer,* Mr. A. G. Salamon.

Dr. Arthur Keith, lecturer on anatomy at the London Hospital Medical College, has been appointed conservator of the museum of the Royal College of Surgeons, in succession to the late Professor C. Stewart.

A meeting was held in Birmingham on March 5, as we learn from the London *Times,* to consider what steps should be taken to assist Dr. Hall-Edwards, the surgeon radiographer who recently had his hand removed in consequence of dermatitis caused by the Röntgen rays. Sir Oliver Lodge presided, and proposed that a fund should be raised which should be invested, and that a committee be appointed to control it. Dr. Hall-Edwards had been a genuine enthusiast on the subject, and his painful condition was the result of his persistent and vigorous work in the cause. He had received a communication to the effect that the king was interested in the matter and in sympathy with Dr. Hall-Edwards, but if a pension were granted it could only be a small one. The Bishop of Birmingham supported the motion, which was carried, and at the close of the meeting it was announced that £309 had been promised.

Drs. Eduardo Liceaga, José Terres, Manuel Toussaint and Octavio Gonzales Fabela have been appointed a commission by the National Medical Academy of Mexico to decide whether the theses in typhus fever submitted to that body deserve the $10,000 prize offered by the government.

Dr. Reginald Heber Fitz, Hersey professor of the theory and practise of physic in the Harvard Medical School, will retire from teaching at the close of the present academic year.

Professor Bosanquet has announced his intention to resign the chair of moral philosophy at St. Andrew's University at the end of the current academical year.

It is proposed to make a grant of £30 from the Worts fund to Mr. A. R. Hinks, of Trinity College, Cambridge, towards defraying his expenses in traveling on the continent of Europe with the view of investigating the methods used in the study of astronomy and geodesy in certain observatories and institutions.

Mr. Frank Leverett, of the United States Geological Survey, is now in Europe, with the purpose of making, in connection with his studies in the United States, a comparative study of the glacial formations of Europe. This study will embrace the deposits in and around the Alps, as well as those of the Scandinavian ice-field in Scandinavia, Germany and Russia, and the British deposits.

Professor W. Sampson Handley gave the Hunterian lecture on "The Natural Cure of Cancer" at the Royal College of Surgeons on March 13.

The council of the British Academy have appointed the Rev. Professor S. R. Driver, fellow of the academy, regius professor of Hebrew in the University of Oxford, to deliver the inaugural course of Schweich lectures under the Leopold Schweich Fund, recently endowed, "for the furtherance of research in the archeology, art, history, languages and literature of ancient civilization, with reference to Biblical study." Dr. Driver

will deliver three lectures on "Archeological Research in Relation to Biblical Study."

THE following course of scientific lectures was given during February at Morningside College, Sioux City, Iowa: Dr. Lynds Jones, of Oberlin College, on "Bird Studies on the Washington Coast"; Dr. Frank R. Lillie, of the University of Chicago, on "The Nature and Physical Basis of Heredity"; Dr. T. H. Macbride, of the University of Iowa, on "The City Beautiful."

THE Philosophical Club of the University of Minnesota has arranged a series of lectures on Aspects of Evolution. The probable program is as follows: "Evolution in Chemistry," Professor Frankforter, February 27; "Evolution in Astronomy," Professor Leavenworth, March 5; "Evolution in Geology," Professor Sardeson, March 12; "Evolution in Biology," Professor Clements, March 19; "Evolution in Psychology," Professor Miner, March 26; "Evolution in Ethics," Professor Wilde, April 2; "Evolution in Philosophy," Professor Swenson, April 9.

THE Chicago chapter of the Sigma Xi Society held its usual winter session on March 4, 1908. At the regular business meeting nine new members were admitted, and a report was presented by Professor S. W. Williston of the business transacted at the convention of the society held January 2. The address of the evening was given by President H. P. Judson on the subject "Research in the University."

IN the Physiological Laboratory at Breslau there has been unveiled, with due ceremony, a marble bust of Purkinje, the eminent physiologist.

TELEGRAPHIC advices from Zacapa, Guatemala, announce the sudden death from a tropical fever of Dr. William Ashbrook Kellerman, professor of botany at the Ohio State University, on March 8. Dr. Kellerman was the head of a party engaged in the study of the flora of Guatemala, especially the parasitic fungi. The expedition, his fourth to that country, was reported to have been very successful and his safe return was soon expected.

SIR ALFRED COOPER, a distinguished London surgeon, has died at the age of seventy years.

THE death is also announced of Professor Laurent, professor of mathematical analysis in the Paris Ecole Polytechnique and Institut National Agronomique.

THERE will be a civil service examination on April 15 and 16 for the position of scientific assistant in the Department of Agriculture, at salaries ranging from $840 to $2,000 per annum, depending upon the experience and qualifications of appointees. As a result of this examination certification will be made to fill the following-named vacancies: scientific assistant in plant breeding, $1,400 per annum, Bureau of Plant Industry (experience in corn breeding in semi-arid or arid regions); scientific assistant in soil bacteriology, $1,400 per annum, Bureau of Plant Industry. On April 22 there will be an examination for the position of assistant in grain standardization (male), Bureau of Plant Industry, Department of Agriculture, at salaries ranging from $1,000 to $1,800 per annum.

PRINCE ROLAND BONAPARTE has placed at the disposal of the Paris Academy of Sciences a sum of $20,000 to be used for grants for scientific research.

MR. PETER WHITE, Marquette, has made a gift of $1,000 to the library of the University of Michigan, Ann Arbor, for the purpose of purchasing rare medical books.

THE valuable collection of more than 2,000 dermatological casts, owned by the late Professor Lassar, has been presented by his widow to the city of Hamburg, his native town. The collection is to be installed in the St. George Hospital.

THE Mount Sinai Hospital, New York City, announces the establishment of the George Blumenthal, Jr., fellowship in pathology with a stipend of $500 a year.

MESSRS. WITHERBY & Co. will publish very shortly an account by Mr. M. J. Nicoll of three long voyages on the Earl of Crawford's yacht "Valhalla." The author describes the bird and other animal life of many islands seldom or never before explored. The valu-

able collections made by Mr. Nicoll during the voyages have been presented to the Natural History Museum by Lord Crawford, who is one of the trustees of that institution.

About thirty members of the New York Physics Club are attending the free course of lectures given to them by the Department of Electrical Engineering at Columbia University. These will be followed by a course of lectures in thermodynamics given by Professor Charles E. Lucke, of the department of mechanical engineering, from 4 to 5 P.M., on Tuesdays in April. All teachers of physics are invited to attend these lectures.

The Harvard Engineering Society will hold its tenth annual dinner at the Union on March 21. Professor Hollis will preside, and the following gentlemen will speak: President Eliot, Frederick P. Fish '75, E. A. S. Clarke '84, president of the Lackawanna Steel Company; George A. Kimball, chief engineer of the Boston Elevated Railway Company; H. L. Smyth '83, professor of mining and metallurgy; George A. McKay, president of the Harvard Engineering Society; and others. In connection with the dinner it is proposed to organize an Association of Harvard Engineers, and a meeting for this purpose will be held at the Union on the same day.

Professor Kamerlingh Ohnes, of Leiden, announces that he has converted helium into a solid. The last evaporating parts are said to show considerable vapor pressures, as if the liquid state is jumped over.

We learn from the London *Times* that at a meeting of the Royal Society held on the fifth ult. Professor Thorpe, of the Government Laboratory, presented a communication on "The Atomic Weight of Radium," in which he gave the results of an investigation he had been commissioned to make by a committee of the society. About two years ago the Royal Society received a considerable amount of the residues from the uranium workings of the mines at Joachimsthal, in Bohemia, belonging to the Austrian government, in which material Madame Curie first detected the existence of radium. These residues have been worked up, partly in France, and partly in London by Dr. Thorpe, who extracted from them the radium chloride which served for his determination of the atomic weight of this rare element. Dr. Thorpe finds from his experiments that the atomic weight of radium is 227, which is in almost exact agreement with the number recently published by Madame Curie.

UNIVERSITY AND EDUCATIONAL NEWS

An anonymous benefactor, considering that the year 1909, in which biologists have decided to celebrate in Cambridge the centenary of Darwin's birth, is a suitable occasion for founding a chair of biology, has offered a sum of £300 a year towards this purpose on condition that it shall be the duty of the professor to teach or make researches in heredity. The council of the senate proposes to create a professorship in biology for a period of five years at an annual stipend of £700.

The chancellor, Lord Rosebery, will visit University College on the afternoon of March 26, and will formally open the new libraries and the new south wing, which includes lecture rooms for the faculty of arts, the departments of geology, hygiene and experimental psychology, also large extensions of the departments of applied mathematics, of mechanical, electrical and municipal engineering, and accommodation for the new hydraulic laboratory.

Col. E. A. Wall, of Salt Lake City, has established a research fellowship ($500) in the State School of Mines, the engineering department of the University of Utah, located at Salt Lake City. This fellowship is awarded annually in June to some graduate student of ability to promote research work in mining, ore-dressing, or metallurgy.

Professor Charles L. Beach, of the University of Vermont, has been elected president of the Connecticut Agricultural College at Storrs.

M. Camille Matignon has been appointed professor of mineral chemistry at the Collège de France in succession to M. H. Le Châtelier, who recently accepted the chair of general chemistry at the Sorbonne.